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THE

ANATOMY

OF THE

HUMAN BODY.

CONTAINING

THE ANATOMY

OF

THE BONES, MUSCLES, JOINTS, HEART, AND ARTERIES,

By JOHN BELL, SURGEON;

AND THAT OF

THE BRAIN AND NERVES, THE ORGANS OF THE SENSES, AND THE VISCERA,

By CHARLES BELL, SURGEON;

THE THIRD EDITION.

IN THREE VOLUMES.

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THE

ANATOMY

OF THE

HUMAN BODY,

VOL. II.

CONTAINING

THE DESCRIPTION

OF

THE ARTERIES AND THE VEINS,

BY JOHN BELL, SURGEON.

THE ABSORBING SYSTEM,

AND

THE BRAIN AND NERVES,

BY CHARLES BELL, SURGEON.

TO

DR. JAMES JEFFRAY,

PROFESSOR OF ANATOMY IN THE UNIVERSITY OF GLASGOW.

DEAR SIR,

WHEN this volume firſt appeared, you mentioned to me ſome doubts concerning the office which I had aſcribed to the Euſtachian valve. You propoſed to publiſh ſome critical obſervations on this part of my Book, and, with a liberality becoming our common profeſſion, and your high ſtation in it, you ſpoke of addreſſing thoſe ſtrictures to myſelf.

It is no ſmall gratification to me, that I have it now in my power to preſent a new Edition of this Volume, imperfect as it is, to one who allows it ſome merit, while he is yet not inſenſible to its defects.

I believe you will accept with pleaſure this ſlight teſtimony of reſpect and eſteem, from one who can have no motive but reſpect and eſteem for profeſſing himſelf in this particular manner

Your moſt faithful and obedient
Humble Servant,

JOHN BELL.

2325

INTRODUCTION.

THE diſcovery of the circulation of the blood has been always regarded as one of the moſt important, and has been ranked rather with the great doctrines of philoſophy, than with the little diſcoveries in our peculiar ſcience; it has been boaſted of by our countrymen, and much coveted, and often claimed, by ſtrangers. The diſcovery is moſt ingenious and beautiful, and is the foundation of all that phyſicians have thought or practiſed, right or wrong, uſeful or deſtructive, ever ſince.

How the well-proved doctrines of Harvey were perverted; what new, ſtrange, monſtrous, and impoſſible circles his antagoniſts contrived for the blood it were tedious to relate; but it is moſt natural to mention why his doctrines were oppoſed. It was the univerſal opinion in thoſe days, that the blood was formed in the liver, and ſent out from it by all the veins to nouriſh the body, proceeding outwards during the day, and returning by night. The old phyſicians had thus entered into a train of thinking which it was not eaſy to change: theſe notions about the blood were become great and important doctrines, and had deſcended to them from their oldeſt teachers, with many weighty dependencies, concluſions, and rules of practice iſſuing from them: they were as articles of faith which it was a hereſy to forſake; and it was eaſy to foreſee, that ſhould the Harveian doctrine prevail; ſhould it be once completely proved that the blood moved outwards along the arteries and returned only

by the veins; then all the reaſonings of the phyſicians would be confounded; their theories embracing the whole body of phyſic diſturbed; their ſyſtem of practice entirely overthrown; and all that they had written themſelves, and all the ancient books which they had read with ſo much diligence (for they were really learned); all that they had ever been proud of; was to be wiped out from the thoughts of that and of all ſucceeding ages!

But the doctrine of Harvey did at laſt prevail, diſpelled thoſe idle dreams of humours and temperaments, and ſpirits, and blood! of the blood concocted in the liver, and moving outwards along the veins to nouriſh the body; of the blood moving outwards during all the day, and returning by night; of the arteries carrying air only or vital ſpirits, to animate the ſyſtem by mixing witn the blood, while the veins alone conveyed the proper blood. Yet this theory of the illuſtrious Harvey introduced general doctrines more miſchievous in all their conſequences than thoſe which had juſt vaniſhed: as, that the blood was compoſed of particular globules, the larger globules of ſmaller ones, and theſe again of globules of a third ſeries; and that the arteries were ſo proportioned to the diameters of thoſe globules, and deſcended by ſteps ſo regular and uniform, that each kind of artery had its peculiar globule which it received with eaſe, while others were rejected; or, if unhappily driven by a too violent action into veſſels which they did not ſuit, were arreſted in their progreſs; and produced either ſome local inflammation or ſome univerſal diſeaſe. Theſe are the once famous doctrines of Malpighi, Boerhaave, and all the great men of their day; and which they dilated into various forms, and adorned with the fine words of lentor, remora, error loci.

To theſe ſucceeded the mechanical phyſicians, who, by untelligible problems of mathematics and algebra (reaſonings which were ill-founded in their principles, even had the calculations been correct), pretended to eſtimate the force of the heart, the velocity of the blood,

blood, the power of the arteries, the ſtrength of the veins, and the ſhape and ſize of each ſecreting orifice, according to the ſecretion which it had to perform. Theſe were the doctrines, theſe the diſcoveries, which rendered famous the names of Bellini, Pitcairn, Keil, Hales, and other mechanical phyſicians, whoſe books are gone "to the vault of all the Capulets."

The chemiſts next ſoon turned their thoughts, from the vain ſearch after the univerſal ſolvent and the philoſopher's ſtone, to pharmacy and the uſeful arts. By the abilities and induſtry of Newman, this branch began to aſſume the more reſpectable appearance of a uſeful art; it began to be allied to ſcience, and its connection with medicine was found to be of the moſt direct and important nature.

Having analyſed the materials of the druggiſt, the chemiſts proceeded to analyſe the parts of the human body to which thoſe medicines were to be applied: but from this rational commencement followed one of the moſt trivial of all the miſerable doctrines with which our ſcience has been diſgraced; for as the chemiſts had already explained the properties of the ſalts, metals, earths, and of all active ſubſtances, by the angles, cubes, or other forms which they ſaw their particles aſſume, they ſoon perſuaded themſelves that ſuch forms as cubes, wedges, ſpiculæ, &c. exiſted in the blood; and acid and alkaline humours, ſharp, corroſive, irritating, and pointed particles, were the terms in which they expreſſed their moſt admired theories; and acids, alkalis, and metals, and medicines for rounding the pointed particles, or obtunding (as they termed it), or ſheathing, or covering the acrimonious humours, were their chief preventatives and cures.

Until the preſent day this fault has pervaded all the great theories, that in deſcribing our veſſels phyſicians have continued to uſe the language of hydraulics and hydroſtatics; of a philoſophy applicable only to rigid tubes: in ſhort, in deſcribing the living ſyſtem, they have forgotten that it was endowed with life.

We

We alſo may have erred in our turn: but with whatever degree of contempt we may view the doctrines of theſe older authors; or however ſucceeding generations may be amuſed with ours—ſtill this is plain, that the moſt important facts in all anatomy, and the chief doctrines of the human body, muſt always accompany the explanation of thoſe two great functions of the heart and lungs. Of courſe the conſtitution of the blood; the chemiſtry of airs; our dependence, ſo inceſſant and immediate, upon the atmoſphere in which we live; the various and ſingular ways by which the fœtuſes of different creatures, or the creatures themſelves, according to their peculiar modes of life, draw their exiſtence from the atmoſphere; the various kinds of circulation by which this air is diſtributed through the ſyſtem of each; the effects of air particularly upon our body; and the effects alſo of accidents, deformities, and diſeaſes in thoſe prime organs—all this wide circle of phyſiology belongs, in the ſtricteſt and cleareſt ſenſe, to the anatomy of the heart. For one chief purpoſe in ſtudying the anatomy of the human body is to underſtand its functions, and to compare them with thoſe of other creatures, till we arrive at laſt at ſome diſtant conception of the whole; of the various ſtructures of animals and vegetables; and of the various functions which in each of theſe claſſes ſupport life, and action, and through it the principle of life.

There is no occaſion on which this deſire of knowledge, this willing admiration of the wonders of nature, is ſo ſtrong as on firſt ſtudying the functions of the lungs and heart; for upon the conjoined offices of the heart and lungs all perfect life ſeems to depend. And how univerſal theſe two functions are; how neceſſary to the ſupport of the greater animals; how eſſential alſo to the conſtitution of the meaneſt inſect—it ſhall be my buſineſs to explain.

The knowledge of the arteries again bears along with it the whole anatomy of the human body. The nerves accompany the arteries; the lymphatics and veins

veins twine round them; the glands and various organs are compoſed of them. The intimate ſtructure of parts is known only by underſtanding the forms of of their veſſels; and as each individual part is nouriſhed by arteries, he who has ſtudied the arteries thoroughly, knows the whole.

But to the ſurgeon the knowledge of the arterial ſyſtem is valuable beyond all calculation or belief. He performs no operation in which arteries are not engaged; he cures no great wound in which arteries are not firſt to be tied; he enters into no conſultation in which the arteries are not firſt ſpoken of. Without a knowledge of the arteries he can neither think ſenſibly nor act ſafely.

Moſt unhappily all this comes to be known only at that period of life when the deepeſt conviction can produce only fear and perplexity, ſorrow and regret. Yet, ſtrange to tell, there is no ſuch conviction; no regret, no irreſolution, no perplexity, is ever ſeen! A ſurgeon, as ignorant of the blood-veſſels as of every other point of anatomy, ſhall proceed in his operations with a forwardneſs and boldneſs terrible to thoſe who know the danger; yet with a ſucceſs and good fortune exceeding all belief.

The cauſes of all this are very plain. A relaxation in the diſcipline of the ſchools is the firſt cauſe—an indifference to anatomy, ſo marked and pointed, that an anatomical theſis in this country was never known. Every young man eſpecially fears the difficulty of this part of anatomy, and ſhuns it. He is not duly impreſſed with ſuch a high ſenſe of its importance as to make labour pleaſant; and when he is advanced to practice, he takes comfort daily from the miſtakes and ignorance of others. A ſlender conſolation! to ſee exemplified in others the faults and dangers to which we ourſelves are expoſed.

If theſe negligencies may ſtand excuſed on any account, it is on this only, That anatomiſts have been accuſtomed to write, not for the Public, in plain and ſimple language, but for each other in an unknown tongue.

tongue. By this I mean not a foreign or a dead language, but a peculiar ſtyle and phraſe which no one can underſtand unleſs he be initiated; unleſs he have ſtudied the ſcience itſelf ſo intenſely, that he has alſo learned the jargon in which it is conveyed: in ſhort, no one but a thorough anatomiſt can underſtand the language of anatomy, nor can even he underſtand it without ſome labour. Anatomiſts have buried their ſcience under the rubbiſh of names; there is not a difficult or hard ſounding word upon which they have any claim, that they have not retained: they have choked their ſubject with uſeleſs minutiæ, they have polluted their language, by transferring to it from Latin many words which, by their continual inflections in that language, were beautiful; while their unvaried, uncouth termination in ours, is barbarous in the utterance, while it tends but to interrupt and puzzle the ſenſe: "they have impreſſed into the ſervice of their ſcience a great many poor words that would get their habeas corpus from any court in Chriſtendom."

An anatomiſt, for example, will deſcribe an artery as "going to the radial edge of the ſecond metacarpal bone: then ſupplying the abductor and flexor muſcles; then going along the bone of the firſt phalanx, ſeated upon this ſecond metacarpal bone," with many other diſtortions, ambiguities, and little contrivances, to conceal (as one would believe) that he is deſcribing ſo ſimple a matter as the artery of the forefinger; which the reader at laſt finds out either by ſome lucky chance, or by reflecting how many metacarpal bones there are; and then reckoning them firſt forwards and then backwards that he may be ſure which it is that the author means; for his author may count from the little finger towards the thumb, or from the thumb towards the little finger, or he may have a fancy of leaving out the thumb, and reckoning only four. What muſt be the ſurpriſe of any well-educated young man when he reads in thoſe books which he muſt ſtudy, of the regions of the elbow or thumb, or forefinger? And if an anatomiſt underſtands ſuch things

with

with difficulty, how diſtreſſing muſt they be to the ſtudent?

This is the ſcholaſtic jargon which has ſo long been the pride of anatomiſts and the diſgrace of their ſcience; which has given young men a diſlike for the moſt uſeful of all their ſtudies; and which it is now full time to baniſh from our ſchools. Theſe are the authors who avoid plainneſs as if it were meanneſs; who are ſtudious of hard words as if they conſtituted the perfection of ſcience: "it is their trade, it is their myſtery, to write obſcurely;" and full ſorely does the ſtudent feel it.

Want of arrangement, again, has ſtill worſe effects. Confuſion is a monſter in ſcience; and Thomſon has, in his Man of the Moon, deſcribed ſuch a thing with great ſpirit and life: "A creature, if that may be called a creature which had no ſhape nor form, next rolled towards him, approaching ſtill nearer and nearer, and by various glances and movements ſeemed to indicate a ſympathy with man: it was a rude unformed maſs; legs and arms, fingers and toes, and membranes and glands, and entrails and teeth, were blended into one abominable maſs."

If I ſhould tell my reader that there are very nearly one thouſand arteries in the body, going promiſcuouſly to bones, ligaments, bowels, and glands, muſcles, and nerves, to a thouſand unconnected difficult parts, all of which he muſt know by name, how would he be affected? But when I obſerve, that theſe go to the neck, the head, the arm, the leg, he begins to ſee this confuſion of muſcles, and glands, and bowels, vaniſh, and to perceive that all theſe arteries may be uſefully and very ſimply arranged. When he is next taught to know the courſe of each greater artery, and the parts in which each diviſion and branch of it lies, he perceives clearly that the parts through which it runs, as the arm-pit, neck, or groin, muſt limit and regulate the number of its branches, and give to each twig even an appropriate place and name: When next the whole arterial ſyſtem is marked and chalked out

for

for him in different portions; when there are points of peculiar importance ſet apart which he is charged to learn with particular care—he ſees a good end in all this toil; he begins with courage, and gets forward eaſily; it becomes an intereſting, and of courſe a pleaſing, taſk. But ſtill it is a taſk: and I entreat the young ſtudent, as he values his own honour, or the ſafety of his friends, not to bate himſelf one iota of the whole. Let him not take an indolent advantage of thoſe arrangements, which are meant to promote his induſtry, not to prevent it. Let him not read only concerning the greater arteries, neglecting the ſmaller ones, but go through the whole piece of anatomy honeſtly and fairly. He will no doubt forget in time the ſmaller arteries; but by having ſtudied even them with diligence, he muſt remember the great and important arteries with a clearneſs of comprehenſion and arrangement, which thoſe who have not gone thus honeſtly through the whole ſtudy can never attain. Let him alſo remember, that ſtudies like theſe, well performed during his early years, do, like paſt dangers, or the remembrance of good deeds, give an eaſe and pleaſure to his after-life.

The arteries, I will now venture to ſay, ſhould be with the ſurgeon as familiar as his name; and there is no argument which proves it more ſtrongly than this, that a man of real learning, of ſterling good-ſenſe, of a clear head and ſteady hand, a man accompliſhed in all other reſpects, and fitted by nature and genius for performing the moſt difficult operations, if yet he want this part of knowledge, may, in one unhappy moment, do things which he muſt think of with horror during all his life. I know well how ſuch little accidents are thought of, when at laſt the evil day comes. A ſurgeon hardly believes this ſtrict knowledge of the arteries to be ſo great a point. In the midſt of an operation, or in a common wound, it gives him no concern to ſee arteries bleed which he did not look for; nor has he great reluctance to drive his needle among parts which he does not know. An artery bleeds, and he

looks for it; he call out at laſt to ſcrew the tourniquet, and it ſtops; the tourniquet is looſened again, and again it bleeds; again the ſcrew is tightened on account of the loſs of blood; he expects to ſtrike the artery; he is accuſtomed to ſtrike it, not by knowing where it lies, but by ſeeing it bleed: at laſt ſome lucky dab of the needle ſucceeds, or perhaps from faintneſs of the patient the bleeding ceaſes: the ſurgeon is relieved from his preſent anxiety; but in a few hours he is called back to this ſcene of confuſion and diſmay: yet at laſt the bleeding is ſomehow or other maſtered; and thus he gets on through all his difficulties, accident after accident, operation after operation, till at laſt he almoſt forgets that anatomy was a branch of his education, or the knowledge of blood-veſſels neceſſary in operations or wounds.

I will not ſay that a man cannot ſuppreſs a bleeding from a wound in the arm, becauſe he is not acquainted with the anatomy of the arm; but this ſurely I may be allowed to ſay, that it is a piece of knowledge which at all times, but eſpecially in thoſe circumſtances, can do no harm; and that if you leave a patient to chooſe betwixt two ſurgeons, one ſkilled in the knowledge of arteries, another knowing them only by ſeeing them ſpout out blood, it is eaſy to foretel where his choice will fall.

Perhaps ſome will be ſo hardened as to ſay, "and yet we ſeldom hear that patients die of bleeding." Is it then a merit that your patient is not plainly killed; that he does not expire under your hands? Is it nothing to loſe blood from day to day? Is it nothing that your patient is reduced to extreme weakneſs, ſuffering every thing but actual death? Is it nothing that he lies with tourniquets round the limbs in fear and anxiety, attended by young ſurgeons appointed to watch that bleeding, which may burſt out while the patient turns in bed, and deſtroy him in one moment? Is it nothing to have freſh inciſions and new ſearchings for the artery to endure?—Theſe are real difficulties and dangers, and they ſhould be provided for; our honour as well

as

as our duty requires it. Bleeding from a great artery is to the patient the greateſt danger: the very report of an ill accident is to the ſurgeon (though, God knows, he may be blameleſs) the greateſt diſgrace; and, laſtly, though it ſhould not be ſo, his taking up a bleeding artery dexterouſly and quickly, when others have failed, is a great honour.

When we think of all the important conſequences of being thoroughly verſed in this part of anatomy, they crowd upon our imagination more in number than can be even named. The ſurgeon may, indeed, provide for the arteries to be cut in a regular operation, by conſulting books; but when he is called to a patient bleeding and faint, perhaps expiring, that perſon muſt live or die by his immediate ſkill! By his ſkill he will obtain the good opinion, not of ignorant attendants only, but of the profeſſion: and by a bold and ſenſible conduct in any difficult ſituation he may give them a leſſon of real uſe. Let us but for a moment think of the chances of thoſe wounded in war;—the alarming, unthought of accidents which overtake us daily in private life;—the wounds and hurts which workmen receive:—let us reflect on all the kinds of aneuriſm both in the heart and arteries, from wounds, from blows, from inward diſeaſes:—let us think of all the various operations in which arteries are concerned—and then declare whether, of all his ſtudies, the young man ſhould not value that moſt which makes him ſo immediately and eminently uſeful.

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THE

THE

ANATOMY

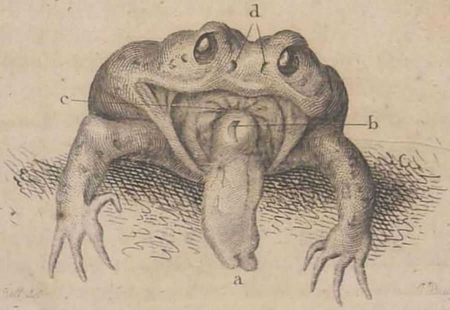
OF THE HEART,

AND OF THE

ARTERIES, VEINS, AND LYMPHATICS.

BOOK I.

RESPIRATION continued.



CHAP. III.

OF RESPIRATION,

OR THE MANNER IN WHICH THE OXYDATION OF THE BLOOD IS ACCOMPLISHED IN VARIOUS ANIMALS.

THOSE who are the beſt acquainted with the comparative anatomy, will beſt know how natural it is for me to illuſtrate this function, by comparing va-

rious animals with man; how pleaſant, how uſeful, it is to know theſe analogies, every ſtudent muſt feel: and it is now full time to correct many miſtakes into which modern as well as ancient authors have wandered, from want of general principles, and from want of anatomical knowledge. I ſhall endeavour to make this chapter intereſting and ſhort.

At one time all authors believed that the lungs were moved, not by any external agent, but by ſome internal power reſiding in the lungs.

When in their firſt eſſays to inveſtigate this ſubject they opened the thorax, or rather the body, of amphibious animals, they obſerved that the creature lay out upon the table with expanded lungs; that the lungs continued for hours to appear like inflated bladders; the lungs expanded, the heart playing, the creature quite alive. When they emptied their lungs for them by thruſting tubes down the trachea, or preſſing the lungs, the lungs entirely ſubſided; but in a little while the lungs, at the creature's will, roſe again into complete inflation; again they appeared like two tenſe bladders. Surely, ſaid they, there reſides ſome expanſile power in the lungs themſelves; but when a few of them began to purſue this miſtake with ſerious experiments, they committed abſurdities which ſhould be noticed, for they ſerve to illuſtrate the true doctrine concerning the expanſion of the lungs.

Mr. Houſton, in our Philoſophical Tranſactions, undertook to prove the following things, which, to uſe the words of a learned author in our univerſity, "are ſo improbable as to be incredible;" firſt, that the breathing of a dog is nothing affected by any wound of the thorax, if only the lungs themſelves be not hurt; ſecondly, that the lungs never collapſe, though the thorax be laid open; thirdly, that when the breaſt is entirely laid open, the lungs continue to move, and the thorax alſo continues to move, but that the motion of the thorax never keeps time with the motions of the lungs. But, to do Houſton juſtice, he endeavoured to

explain

explain away the inconſiſtencies of his own experiments; and the world would never have been troubled any more with them, had it not been for a Mr. Bremond, a great academician, philoſopher, and experiment-maker, who publiſhed the following ſuite of experiments in the academy of Paris.

His firſt miſtake is this. "I found (ſays he) that having ſtabbed a Dog in one ſide only, it could run about the houſe and howl." This is what nobody will doubt. "But alſo (ſays he) the air which the Dog took in by the wound when it expired, was preſſed out again by the wound when it inſpired." This is one cunning ſtroke of Mr. Bremond; for had the air entered the cheſt during inſpiration, that muſt have proceeded from the riſing of the thorax, which is not the kind of reſpiration which he wanted to prove: But as the air entered the cheſt during expiration, it proceeds clearly, according to his principles, that the lungs in ſqueezing out their air have a contractile power; that they contract by their own motion, and leave the ribs, and ſo make room for the air.

"Next (ſays Mr. Bremond) I opened the thorax of a living Dog, and there I ſaw, that when the lungs contracted the thorax dilated, and when the thorax contracted the lungs dilated."—But, in fact, it means no more than this, that often in theſe agonies produced by ſuch cruel experiments upon animals, or by actual wounds in the human body, the diaphragm, cheſt, every thing which contributes to breathing, is ſo cloſely contracted, and the preſſure is ſo great, that the lungs are actually compreſſed and protruded: ſo that his ſeeing, as he ſays, the lungs dilated, that is, ſqueezed out, when the thorax contracted, is like the ignorance of a child looking from a carriage window, who believes and wonders at the trees and houſes running backwards. But as no experiment-maker ever allows his experiments to remain incomplete, Mr. Bremond finiſhes his by the following daring aſſertion, "that always when he made his inciſion no more than three inches long, the lungs dilated themſelves with ſo much violence that they drove

out the air before them, protruded themſelves through the opening, and made the blood jerk out at all points *." In ſhort, he repeats this miſtake in every poſſible form, viz. that the motions of the lungs and thorax are directly oppoſite to each other; that the lungs are contracting while the thorax dilates, and the thorax contracting again when the lungs dilate. When I open a Frog, it fills its lungs with perfect eaſe after both its breaſt and belly have been entirely cut away. "If admitting air into the thorax could really make the lungs collapſe, why do not thoſe of the Frog collapſe?" This is ſuch groſs ignorance as ſhould not have been endured in one reading papers before the Royal Academy of France. He is farther back in phyſiology than Oligerius, Jacobæus, or Malpighi.—The Frog has a reſpiration peculiar to itſelf, or at leaſt to its kind.

FIRST SPECIES OF RESPIRATION, VIZ. BY A DIAPHRAGM.

Under this title I ſhall explain the reſpiration of Man, and of animals like Man; which have heavy lungs, of a ſtrong fleſhy texture, a prodigious number of blood-veſſels paſſing through them, their lungs lodged entirely in the cheſt, and their reſpiration performed by a diaphragm.—I mean to arrange reſpiration according to the mechaniſm of thoſe organs by which it is performed; and place in the firſt order that of Man, and animals which in this point reſemble Man; and I ſay reſpiration by a diaphragm, for this is indeed the only uſe of a diaphragm. The ſupport of the great blood veſſels, the compreſſion of the viſcera, the expulſion of the urine and fœces, the ridding the womb of its burden; all could have been performed by the preſſure of the abdominal muſcles alone! the diaphragm is added merely for breathing.

* If one word of this were true, what would become of thoſe who had adheſions of the lungs? Surely if the lungs and thorax moved in oppoſite directions, the one contracting while the other dilated, the force of the lungs never could pull down the thorax.—Such patients muſt die.

Forſaking,

Forſaking, for a moment, authority and minute anatomy, let us explain it in the ſhorteſt and moſt intelligible way.—The diaphragm divides the thorax from the abdomen; it is ſtrong, muſcular, and acts with great power, enlarging the thorax; it is convex towards the breaſt, and concave towards the belly: when it acts, the belly is protruded, the diaphragm becomes flat, the thorax is enlarged, and a vacuum would be formed, but that inſtantly the lungs follow it and prevent a vacuum; for the lungs are free in the thorax, the air has free acceſs to go down into the veſicles of the lungs; and ſo when the diaphragm retires, the lungs follow it, being dilated by the preſſure of the air which enters by the trachea.

But this protruſion of the belly excites the abdominal muſcles to re-act; their preſſure reſtores the diaphragm to its natural form; when preſſed back again by the abdominal viſcera, it riſes in the thorax, becomes again convex towards the lungs, the thorax is reduced in ſize, the lungs are compreſſed, and that air is driven out again which they had juſt received. The thorax alſo moves in concert with the diaphragm: and this motion is moſt curiouſly arranged; for, firſt, the intercoſtal muſcles lift the thorax for reſpiration, in the very moment in which the diaphragm is preſſing down, and conſequently at the inſtant when the abdominal muſcles, which are attached to the lower borders of the thorax, are relaxed, ſo that they ſuffer it to riſe. Next, the thorax is to be compreſſed and pulled down by the abdominal muſcles; and this happens at the very inſtant in which the abdominal muſcles re-act againſt the diaphragm; ſo that the abdominal muſcles, while they thruſt back the diaphragm, pull the lower edges of the thorax down with great power.

Thus in Man, and almoſt all animals, the reſpiration is performed by a diaphragm.

SECOND SPECIES OF RESPIRATION, VIZ. THAT OF BIRDS.

Birds are ſuppoſed to breathe like Man, but have in fact no diaphragm to divide their body; they have veſicles, or air bags extending through the whole body, and connected with the true lungs; their ſternum and ribs expand over the whole, and by their motion move the air veſicles, which blow the air through the true lungs; while the true lungs, far from having any thing to do with a diaphragm, never move.

Every one ſkilled either in anatomy or phyſiology muſt know, that one of the greateſt phyſiologiſts of our times has written a long paper about the reſpiration of birds, little underſtood, and in proportion much admired; of which function he is ſo thoroughly ignorant, as to explain how they breathe with a diaphragm: and until I ſet this point right, my arrangement is good for nothing.

"The diaphragm of fowls (ſays Mr. Hunter,) is thin, tranſparent, and membranous, and runs acroſs the abdomen." But if thin, membranous, and tranſparent, it can perform none of the functions of a diaphragm, and muſt be merely ſuch a membranous interſeptum as ſome Amphibiæ and Reptiles have, ſupporting the viſcera, or confining them in their place. But he thinks to make good his point by acknowledging the imperfection of this diaphragm; and adding, that it is moved by certain ſmall muſcles, which ariſe from the inner ſurface of the ribs, and pull the diaphragm and lungs down. He ſtill perſiſts in calling it a diaphragm, in the very ſentence in which he informs us that "it is perforated in many places with holes of a conſiderable ſize." Since Mr. Hunter is ſo bold as to ſay of other authors, that they have too limited notions of a diaphragm, we may be allowed to ſay, that his notions of it are as much too liberal as theirs are too confined. But deſcriptions and arguments of this kind, where the author is entirely wrong, ſhould

not be tedioufly refuted, nor anfwered in any other way than by a fimple ftatement of the cafe *.

The anatomy of a fowl's refpiratory organs is plainly this.—The trachea having defcended into the thorax, divides into two branches; of which one goes in a fimple and ordinary manner into each fide of the lungs. The heart, which lies immediately upon this divifion of the trachea, fends into the lungs two great pulmonic arteries, and receives in return two veins. The lungs themfelves are very fmall, denfe, and bloody; they are fomewhat of the fhape of the human lungs; they are feated in the very uppermoft part of the cheft, are clofely braced down to the back, and are indeed in part niched in among the ribs, which in birds have their edges very deep. Thefe are the true lungs for oxydating the blood; they never move; the air paffes through them in the following way.

Thefe lungs cannot move, becaufe they are braced down by a membrane very thin, and cobweb-like, yet very ftrong. This membrane is a peritoneum, lining at once the whole thorax and abdomen (which ftill are not parted from each other), and it is a covering to the lungs, liver, and other vifcera; but alfo the fame cobweb-like membrane forms cells, which fill the whole cavity from the neck down to the anus, and from the breaftbone to the back; and which are fo attached to all the furfaces, being, as I have faid, the lining membrane, that as the breaft moves, thefe cells muft move.

Thefe cells appear at firft fight quite irregular; and

* For the refpiration of birds, *i. e.* for raifing and depreffing the thorax, I fee many mufcles having a very ftrong analogy with thofe of Man. The pectoral mufcles are amazingly ftrong, and their fcapulas abfolutely fixed, fo that thefe could raife the breaft with great power; but I fufpect that no fuch power is needed, that the elafticity merely of the fternum and ribs raifes them. There lies under thefe, upon the back, a very ftrong mufcle like our ferratus pofticus. There lies on the infide of the ribs a fet of three beautiful mufcles like large intercoftals: they are quite infulated from all other parts, are feen inftantly upon opening the belly: thefe are what Mr. Hunter calls Mufcles of the Diaphragm; but in truth the breaft of a bird is pulled down ftrongly by its fhort yet ftrong abdominal mufcles, and rifes again by its own elafticity with little help; and thefe are merely intercoftal mufcles.

 Mr.

Mr. Hunter gives but an idle defcription of them along with that of the feptum, which he calls the diaphragm: But I hold it as a principle, that, although we may not fee it, yet all is orderly in the animal body; in fact, the order of thefe cells is extremely regular: Firft, there is a membrane which comes down from the breaft-bone in a perpendicular direction till it touches the vifcera; it runs the whole length of this common cavity of breaft and abdomen; it enters into the great cleft of the liver, and fo divides the liver into two lobes, ferving as a ligament for the liver, as a mediaftinum to divide the great cavity into two, and alfo as a fort of root or bafis for the cells of either fide; though beautifully tranfparent, it is very ftrong. At the upper end this mediaftinum touches the heart, and there expands into a very large bag exquifitely tranfparent, which is at once an air-cell and a large pericardium. Next, at its lower end, it touches the gizzard or ftomach, and forms a large cell furrounding it. Behind the liver, which fills all the upper part of this great cavity, and the gizzard which fills all the lower part, lie all the inteftines, which are alfo furrounded with many cells: at the fides the cavity is occupied by three or four large cells extending from the middle membrane to the flanks of the bird. And, laftly, when we look into thofe greater cells which are neareft the lungs, we fee clearly many openings, very large, oblique, running flat under that part of the membrane which braces down the lungs, fo as to communicate the air from the lungs to all the cells very freely.

Now let me add, in one word, that the effential parts of refpiration are thefe: Firft, there is no diaphragm, no divifion of breaft and belly, the ftomach lying upon the rectum in the pelvis; a true and mufcular diaphragm could not exift in birds, having nothing to do in their fcheme of refpiration. Secondly, The true lungs are fmall, high in the back, quite immoveable, fo that no diaphragm nor no power of vacuum could unfold them; and thefe lungs are perforated at every point, fo that they could not expand by air. Thirdly, What has been confounded with the true lungs is the vaft congeries of abdominal

abdominal cells, which are of uſe only in lightening the creature that it may fly, and in forcing the air through the true lungs. Fourthly, there is in the place of a divided abdomen and thorax, with long abdominal muſcles, no proper abdomen, a long thorax, a high ſternum, and very elaſtic ribs, extending along the whole body till they almoſt meet the pelvis, making the abdominal muſcles very ſhort; and the air-cells all along adhere to the inner ſurface of theſe bones.

With theſe points clearly before us, we cannot miſtake the mode of reſpiration in birds. The thorax does the whole; the thorax is raiſed, and immediately the cells are expanded, by which two functions are performed; for the air which comes into the cells, paſſing through the lungs, oxydates the blood, and the cells become full at the ſame time ſo as to make the body ſpecifically lighter. The thorax is depreſſed again, and the air, which paſſes now a ſecond time through the lungs, may a ſecond time oxydate the blood, for it is not thoroughly ſpoiled; and what is ſpoiled is diluted with the air of many cells, which reſpiration cannot empty at one ſtroke.

The final cauſe alſo is plain: Had the lungs in a fowl been ſolid and fleſhy as they are in fowls, (or even in any other creature,) and at the ſame time ſufficiently large to perform, without the help of thoſe air-bags, all the functions of lungs, they muſt have been large and heavy in proportion to the body of the fowl; they muſt have occupied much room, and added much to the weight. But the lungs of a fowl are very denſe, very ſmall in proportion to its ſyſtem, very full of blood, quite fixed, and undilatable; the rapid courſe of the air through them backwards and forwards enabling them in their buſineſs of oxygenation to do much with little. In ſhort, there are two functions to be performed in birds: Firſt, the oxydation of the blood, which is performed by the ſmall, fleſhy, contracted lungs, which lie immoveable in the upper part of the thorax, and through which the air blows continually

as

as through a furnace, while they are quite paſſive; and, ſecondly, the lightening of their bodies for flying, which is performed by the abdominal cells. It was alſo neceſſary that the ſternum and bony compages ſhould be large in order to afford ſpace for the origin and lodgement of the muſcles of the wings, and to enable them to raiſe the whole weight of the body in flying. The deſcribing of a diaphragm, and the confounding of the abdominal cells with the true lungs, where none can be, was like to have put us all wrong *.

THIRD SPECIES OF RESPIRATION, VIZ. THAT OF AMPHIBIA.

THIS ſpecies of reſpiration differs from the two firſt in theſe reſpects; it differs from the reſpiration of Man, becauſe there is no diaphragm; it differs from that of birds, for there is no cheſt covering the lungs: There is a ſhort ſternum, no cheſt, no ribs by which the lungs may be moved, there is no vacuum formed in their reſpiration;

* PLANS of the RESPIRATION of BIRDS.

In the firſt Plan is ſeen—(*a*) The trachea dividing into branches —(*b*) The heart ſending great pulmonic arteries to the lungs—(*cc*) The true lungs ſhaped like the human, but exceedingly ſmall, denſe, and bloody—(*d*) The thin and delicate membrane, which forms a mediaſtinum—(*e*) The great air-cell, in which the heart lay—(*f*) The cell where the ſtomach lay—(1, 2, 3, 4, 5.) A number of cells, very large, which ſurround all the viſcera, and fill the whole abomen—(6, 6,) Two large cells which lie neareſt the true lungs—(*gg*) The true lungs, which lie cloſe to the back-bone.—At (*ii*) is ſeen on each ſide one of the many holes by which the true lungs give out their air to the abdominal veſicles. Figure 2d ſhows the manner of their reſpiration; for the air-veſicles are ſeen again (1, 2, 3,)—filling the whole abdomen. The true lungs are ſeen at (*a*)—lying cloſe by the ſpine, and as high as the root of the neck; and the length of the ſternum and ribs, which are marked (*b*, *c*, *d*, &c.)—ſhow that the fowl is all cheſt, and that every time the cheſt riſes to the line (*hhh*)—the veſicles are dilated, and the air paſſes through the lungs in the direction (*i*)—and every time the breaſt is pulled down by the abdominal muſcles, which are marked (*k*)—the air is driven out again through the lungs in the direction (*m*),—the lungs being all the while motionleſs, and paſſive merely.

Respiration of Birds

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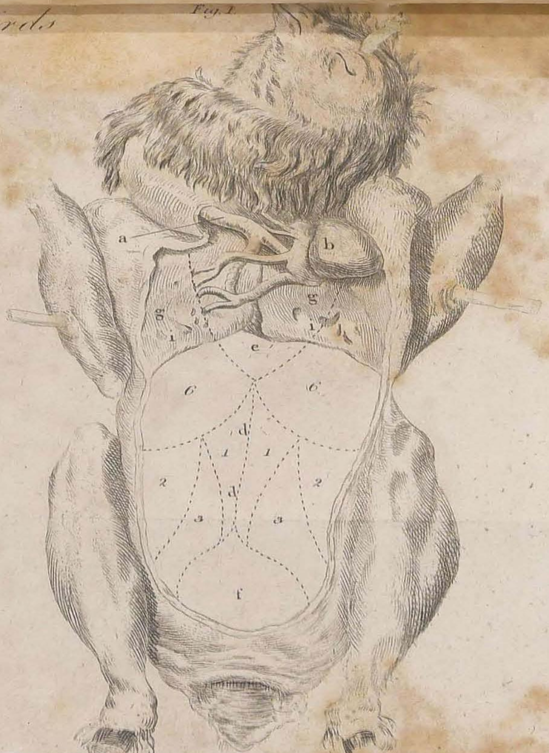
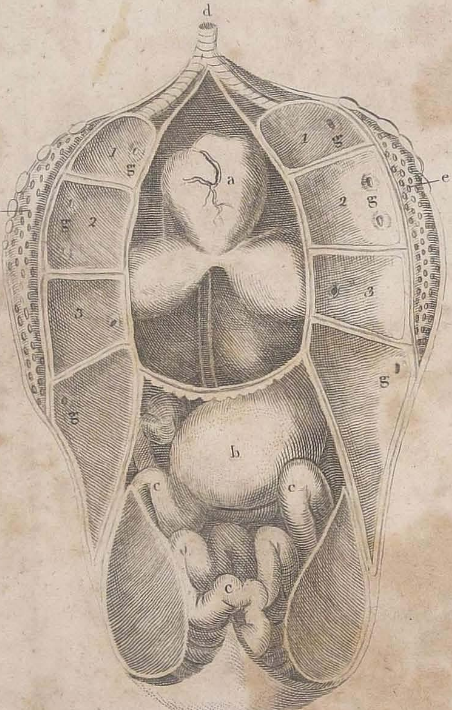
Fig. 2

Fig. 1



I Bell sculp

The Ostrich's Lungs
drawn by the Parisian dissectors



a The Heart lodged in one great Air Cell b the Stomach and c the Intestines surrounded by other great Cells. d the trachea branching towards the lungs. e e The true lungs firm fleshy very small & fixed down to the backbone. 1 2 3 other great Air-Cells in immediate contact with the Lungs & communicating with all the other Cells. the holes g g g &c are the openings by wh the Cells communicate with the Lungs & with one another.

ſpiration; they fill the lungs by the working of their jaws, or, in other words, they ſwallow their air juſt as we ſwallow our food.

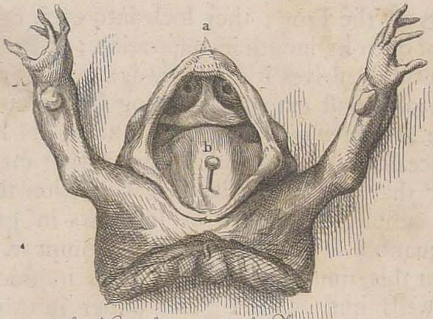
The Frog, the Newt, the Camelion, the Tortoiſe, and many other creatures, breathe in this way; and as one of the moſt curious mechaniſms for reſpiration, I ſhall repreſent that of the Frog. I have placed at the beginning and end of this chapter two drawings, in which their organs of reſpiration are ſeen; for, as I have juſt explained, their organs for moving the lungs are not in the cheſt, nor in the lungs themſelves, but in the throat. At (*a*) is ſeen its tongue of prodigious length; it is not like the tongue of any other creature, hinged far back in the mouth, but is fixed in the chin to increaſe its length, while at the further end it is forked. We ſee it launching out this monſtrous tongue in catching flies; perhaps alſo with this it rakes mud. At (*b*), behind the root of the tongue, is the ſlit-like opening of the trachea; this is what is called the glottis in the human ſubject. We ſee this rima opening and gaſping for air when we keep the mouth thus diſtended; it has no epiglottis or valve to defend it; its own contraction is ſufficient, for when cloſed you cannot even gueſs at its place; beſides, the jaws force down the air into it, and the long tongue carries the food over it into the gullet. At (*c*) is ſeen the opening of the gullet, which when dilated is as wide as its jaws; it looks more like the ſtomach opening directly into the throat; and this great width requires a very ſtrong muſcle to contract it, and makes a great circle of rugæ. At (*d*) is ſeen the moſt important part of all, the noſtril of the Frog, with which it continually breathes, never opening its mouth.

Looking careleſsly upon this creature, we do not perceive that it ever breathes, for it lies plunged over the mouth in water. It is never ſeen to open its mouth; there is no motion in its ſides like breathing; in ſhort it does not ſeem to breathe; and when it is provoked, (or rather through fear,) though it ſtill keeps its mouth cloſely ſhut, its ſides and back riſe, and it blows itſelf up apparently by ſome internal power. But when

we obſerve the creature more narrowly, we perceive that there is a frequent motion of its jaws, or rather of that ſkinny and bag-like part of its mouth which is under the lower jaw. We are apt now to fall into a worſe miſtake, for this bag under the jaw is alternately dilated and contracted, the mouth is never opened to take in new air; the creature ſeems to live all the while upon one mouthful of air, and ſeems to be playing it backwards and forwards betwixt its mouth and its lungs.

But, laſtly, when we obſerve its noſtrils, we find that there is in the noſtrils a twirling motion for each movement of the jaws, which makes the whole proceſs perfectly ſimple to our comprehenſion; for a Frog breathes by the noſtril alone, it cannot breathe by the mouth; it never raiſes its mouth above water, nor opens it but to catch flies or other food. If you keep its mouth open, you ſee it preſently ſtruggling for breath; for its reſpiration goes on in the following way: Its broad jaws are continually ſhut; they lock into each other by grooves; the mouth is completely cloſe, and forms a ſort of bellows, of which the noſtrils are the air-holes, and the muſcles of the jaws which come from the os hyoides draw in the draught by their alternate contraction and relaxation; and the noſtrils lie ſo obliquely over the hole in the ſkull, which is repreſented at (*a*) in the Plate at the end of this chapter, that the leaſt motion of them enables them to perform the office of a valve. Firſt there is a twirl of the noſtril which lets in the air; then a dilatation of the bag under the jaws, by which the mouth is greatly enlarged and filled with air; then a ſecond motion of that bag, by which the mouth is emptied and the lungs filled; then there is a ſlight motion of the ſides of the creature, by which the muſcles of the abdomen expel the air again; and then the twirl of the noſtril and the motion of the jaw ſucceeds again; ſo that with theſe creatures inſpiration is the ſwallowing of the air by their broad expanded jaws, with their coverings driving it down into the lungs; and expiration is the contraction of the abdominal muſcles driving

driving it out again: and theſe two motions, when we obſerve a Frog attentively are as perfectly regular as reſpiration in a Man. Their muſcles of reſpiration are not the muſcles of the belly but the muſcles of the jaws; and this cauſes the uncouth broadneſs of the jaws in Frogs, Newts, Lizards, Serpents, Turtles, &c.



the Nostrils — b *the Tongue*

Now we ſhall no longer wonder why the Frog never opens its mouth; why it never ſeems to breathe; why, after opening its belly, the lungs ſtill project; why, after emptying its lungs, it can fill them again at will, not by any peculiar power in the lungs, but by blowing them up with its jaws. If you gag the Frog and keep its mouth open, it cannot fill them, becauſe it cannot breathe; if you plug its noſtrils, it ſuffocates, though not ſoon; if you keep its mouth open by force, you ſoon find it ſtruggling for breath; and looking into its throat, you ſee the glottis opening from time to time *.

The Newt (or as it is called in this country, the Aſk) breathes with the jaws and noſtril like the Frog; it has, like the Frog, a conſtant motion by ſhort ſtrokes of the bag under the jaw (which bag is formed by the membranes of the mouth, covered and moved by the genio-hyoidei and mylo-hyoidei muſcles), but we obſerve that every minute, or leſs, it ſtops as if intending ſome particular motion; then gradually the bag ſwells out under

* Dr. Monro, in his explanation of Plate 16. ſhows us very obligingly the diaphragm of a Frog, marked (*c*).—This diaphragm is mentioned a ſecond time in explaining the ſame Plate.

the

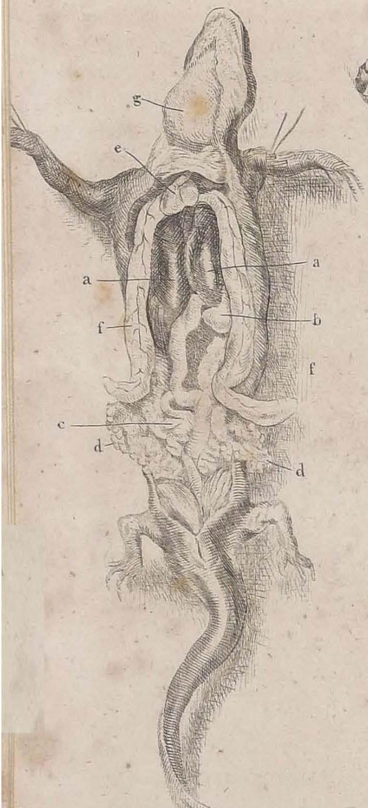
the lower jaw to a great ſize; then the air contained in it is puffed down into the lungs with a ſudden flap of the bag; and in proportion as the jaws are emptied the long ſides of the creature are heaved up.

The Toad, the Camelion, the Green Lizard, breathe exactly in the ſame way. The Camelion has the flat broad jaws of the Frog; they lock into each other, and it does not open its mouth in reſpiration; it ſwallows its air in mouthfuls, drives it downwards into its lungs; its lungs are of a vaſt extent, ſtretching from the jaws all along the abdomen: it is the vaſt ſize of its lungs, almoſt concealing the abdominal viſcera, that makes Geſner ſay, "that of the entrails of a Camelion the lungs only are viſible." The air it ſwallows in greater or ſmaller quantity as its needs or fears prompt it. When you alarm this timorous animal, it fills its ſides juſt as a Frog ſwells out its back; and either in this greater reſpiration, or in its ordinary breathing, we ſee it preſſing the air onwards from cell to cell; and we ſee the motion proceeding from its jaws to its breaſt, and all along its ſides, till its lank form is quite puffed up almoſt to burſting.

All theſe creatures have, in addition to their peculiar reſpiration, a peculiar kind of lungs, thin, membranous, and extremely delicate: the lungs even of ſo great an animal as the Crocodile are, when inflated, very delicate and tranſparent, of a roſe colour or ſlight red, conſiſting of delicate veſicles, and exactly like the Frog's lungs. The lungs of the Frog are in ſhape like a fir-cone, with the ſtalk of the cone on each ſide fixed to the ſide of the heart. But theſe conical lungs of each ſide are delicate, ſilvery, perfectly tranſparent, divided within into innumerable cells like a honeycomb; and theſe alſo are ſo extremely delicate, that though the outſide membrane is as tranſparent as a ſoap-bubble, the diviſions can hardly be ſeen, except by inflating and drying the lungs, and then cutting them. The lungs of the Aſk are ſtill more beautiful, as a ſpecimen of what are called membranous lungs; for the creature is very long in the body, its lungs run down along all its ſides; they

are

Neut



Frog

In the Frog aa is the Liver b the Spleen c the Stomach d the Intestines e the Heart ff its conical vesicular Lungs In the Neut a the Liver b the Stomach c the Intestines d Ova in the Ovaria or Egg-beds e the Heart ff Thin vesicular Lungs which are long like Intestines & transparent like the swimming bladder of a Fish g the Bag of the Jaws by which the Lungs are blown up

are about the ſize of a common earth-worm or writing quill; they end like a blind gut; they are of a bluiſh-white, exquiſitely tranſparent, like the ſwimming bladder of a fiſh.

It is the nature of membranous lungs to oxygenate but a very ſmall quantity of blood; they are membranous, only becauſe there is not that vaſt profuſion of arteries, veins, and ſtrong veſicles, which there is in the human lungs. The pulmonic artery and vein are always, in the membranous lungs, extremely ſmall in proportion to the vaſt ſyſtem which they ſerve. There cannot be better examples of this fact than theſe two drawings of a Frog and of a Newt: In the Frog is ſeen the ſmall artery and vein ſpreading more ſuddenly over the lungs; in the Newt is ſeen the ſame artery and vein, running down more directly, and for a greater length along its lungs: in both we ſee the artery to be little bigger than the ranular arteries of the Frog's tongue at the head of the chapter. The manner of its coming off from the aorta is ſeen in the firſt plan in the book, where figure 2. repreſents truly the Frog's heart; and there we may obſerve how ſmall a proportion the pulmonic artery bears to the reſt of the arterial ſyſtem.

From theſe peculiarities of the membranous lungs, it is plain that the oxydation of the blood is a proceſs of ſmall importance in their ſyſtem; that this proceſs being of little value with them, they are the better enabled to go into the water, and to want breath for a time. But chiefly it appears, that the meaning of this peculiarity is not ſo much to give them the privilege of Amphibiæ, in allowing them to go into the water; for many creatures, as the Camelion, all the tribe of Lizards, Newts, Toads, Serpents, &c. have theſe lungs, and yet never approach the water: but that the chief uſe of it is to eſtabliſh in this claſs of animals a peculiar conſtitution, a permanent, almoſt inexhauſtible, irritability, and a tenaciouſneſs of life; which, I believe, no creature, whether of the land or the water, wants, which has membranous lungs. And when we are told that theſe creatures can be kept two days under water,

as

as a proof of their being Amphibiæ, I cannot but confider it as a very childifh proof; for, in the firft place, we fee them breathing with wonderful regularity when out of the water; when plunged into the water, we fee them very foon ftruggling for breath, and if they can live for two days without air, it is only becaufe they could bear any other kind of injury with equal eafe, and could live two days without their heart or their head.

FOURTH SPECIES OF RESPIRATION, VIZ. THAT OF FISHES.

In this fpecies of refpiration the creature breathes neither water nor air, but water mixed with air, and this office is performed by gills in place of lungs.

The reafon why I have called this a fpecies of refpiration, needs to be very fully explained; for, though little obferved, it is a certain fact, that a creature, without any apparent change upon its fyftem, can do well, having its blood oxygenated at one time by gills, at another time by lungs. The Frog, for example, lives long in the water; while it does fo, it may be confidered as a fœtus which cannot breathe: the young Frog which has not yet acquired its proper and natural refpiration, breathes like a fifh. For the firft fourteen days after hatching from the egg, and while the Tadpole is very fmall, it has gills, which are two long, projecting, fimbriated appendages like fins; by the thirty-fixth day thefe appendages are taken into the jaws, and form four rows of gills on each fide, regular, and like thofe of a fifh; but at the fame time, this fœtus has its lungs within the body, not to be ufed till it come out into the air, when the lungs affume their function and the gills fhrink. The fame fyftem in this inftance, which was at firft ferved by gills, is in the end oxygenated by lungs.

The motion of the gills in fifhes is a true and perfect refpiration: for, in the firft place, if there be no air in the water, or not enough of air, they cannot breathe; diftilled water is to a fifh what the vacuum of an air-pump.

pump is to a breathing creature: if you exhauſt water with an air-pump, if you boil it, if you diſtil it, if in any way you deprive it of its air, fiſhes cannot breathe in it, but come up to the ſurface and gaſp for air. If you take a fiſh out into the air, it is the ſame with plunging any breathing creature into water, it gaſps and dies. Fiſhes cannot breathe in air wanting water, for that element is not accommodated to their ſpecies of lungs; nor in water wanting air, for then there is no oxygene; and we find, upon extracting the air from water which fiſhes have breathed, that it is contaminated, exactly in the ſame way with air which had been breathed by any breathing animal, and that it differs very little from that in which a candle has burnt out. This is the reaſon that when many ſmall fiſhes are incloſed in a narrow glaſs, they all ſtruggle for the uppermoſt place, and that when in winter a fiſh-pond is entirely frozen over, you muſt break holes for the fiſhes, not that they may come and feed, but that they may come and breathe; without this, if the pond be ſmall, they muſt die.

In the reſpiration of fiſhes, there are two curious points to be conſidered: Firſt, The manner in which their reſpiration is performed; and, ſecondly, The manner in which their blood, when thus oxydated, is diſtributed over the body.

The red part or gills, which ſerve as lungs, lie under a broad ſcale, which defends them from all extraneous bodies, or hurt, or preſſure of any kind, for they are exquiſitely delicate. Their reſpiration is like the Frog's in this reſpect, that they ſwallow the water with their mouths; and in this it is like the fowls, that they drive it through among their gills; which lie perfectly paſſive like the true lungs of a fowl.

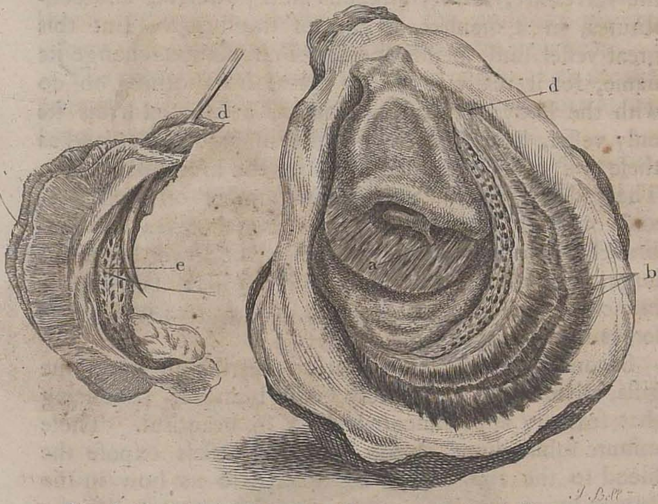
A fiſh's gills are ranged in ſemicircles under the great flap which covers them four or five ſemicircles on each ſide; the fiſh opens its mouth wide, fills it with water, ſhuts the mouth, then drives the water backwards, ſo that it lifts the great flap and makes its way out behind, and ruſhes with a ſort of ſtream through among the red gills, raiſing each ſemicircle from another, and making the

the water play freely round each feathery-like procefs. It feems to me, that wherever this mixture of water and air is ufed, there muft be fome force to give impreffion to the air upon the blood. The depth to which fifhes go, and the preffure of the water, muft give fome effect in impreffing the air upon the lungs. The gill muft play more or lefs ftrongly according to various depths, juft as the fifh muft fwim more ftrongly againft a ruder ftream. Some fifhes, as the Trout, Perch, Salmon, Herring, have more open gills, yet they do not want this power of impreffing the air more or lefs ftrongly againft the gills. The Eel and the flat fifhes, as the Skate, have their gills more concealed. They fwallow the air by the mouth, and breathe it out by holes in their fide. The fhell-fifhes give the moft curious example (and none more fingular than the oyfter) of very regular and beautiful gills; and therefore I have given two flight marginal drawings; the firft of which fhows the heart and lungs at (*a*).—

a.a. *Gills of a Trout* —b *Its Heart*
c.c. *the Arteries of the Gills*

The heart, which may be feen beating about 40 in a minute at (*b*)—The whole of the gills as they lie out upon the fide of the Oyfter, and bear a very large proportion to its body. The canal is partly opened, in which the water paffes to the gills from the mouth (*d*) —And at (*e*, figure 2.) is feen, feparated from the body, a long canal opened; before it was laid open, it was fomewhat of a triangular figure within; it conftitutes the bafis of all the circles of gills; it contains the moft beautiful ranges of holes that can be feen in nature, by

by which, as is very plain, the water is admitted to each feather of each gill. The fiſh ſwallows the water by its mouth, which is at (*d*, figure 1.)—drives it down into this great canal, and ſo out again. It is by this, I am perſuaded, that merely the ſoaking of a fiſh's gills in water would not do, for they might have lain abroad, as indeed they do, and ſoaked very ſecurely in a ſhell-fiſh; but the water muſt be applied with a degree of force proportioned to the condition of the lungs, or the needs of the ſyſtem; and every fiſh, whatever be the mechaniſm of its reſpiration, has this power.



Having explained this firſt point, viz. the mechaniſm of their gills, I proceed next to explain the circulation of their blood, how their blood is oxydated, and how it is diſtributed over the body.

A fiſh and an amphibious animal have both of them the ſimple heart, conſiſting of one auricle and ventricle, but with this ſingular variety, that the Frog, for example, wants the heart belonging to the lungs, a ſmall artery only from the common ſyſtem performing the office; while the fiſh again wants the heart, which ſhould circulate the blood through the body, and has that heart

only which belongs to the lungs. The whole blood of the fish passes through this single heart, and therefore the whole mass circulates, parcel by parcel, through the gills, for every time that it circulates through the body. We shall begin its circulation, then at the heart. First, The whole blood of the body is returned into the heart of a Skate, by two great veins. These two great veins deliver it into a vast auricle, or reservoir rather, which lies over the heart. The auricle delivers it into a strong ventricle, whose action is further strengthened by the action of its aorta, which from the heart up to where the valves are, is very muscular and powerful, and constitutes, in a manner, a part of the heart. But this great vessel must in this species of circulation change its name, for it really is not an aorta, has nothing to do with the body: both the heart of a fish, and this its only vessel, belong entirely to the lungs or gills, and as these are called bronchiæ, this is the bronchial artery. The gills of this fish are five in number on each side, and on each side the bronchial artery gives out two branches which serve the five gills; the lower branch is large, and serves the three lower gills; the higher branch, which goes off like one of the arms of a cross, serves the two upper gills.

Secondly, These arteries being distributed along the gills, divide into exquisitely small branches producing that feathery appearance which is so beautiful. Those minute subdivisions of the bronchial vessels expose the blood to the air. This may explain to us how in the human lungs the exposing of the blood, even with the interposition of membranes and of the arterial coats, may be sufficient for the oxydation of the blood. All the blood thus oxygenated is returned by veins, corresponding exactly in number and arrangement with their arteries; and the heart being turned aside, and all the other viscera taken out, the veins are seen accompanying their arteries and emerging from the gills to form the aorta.

Thirdly, the aorta is formed by the veins of the gills, and the veins of the gills lie close upon the skull of the fish,

fiſh, and the aorta upon the back-bone; and this veſſel is in one ſenſe a vein, ſince it is a continuation of thoſe veins which return the blood of the gills; but both in office and form it is a true aorta; in office, becauſe it diſtributes blood to the whole body; and in form, becauſe it no ſooner ſwells out into the ſhape of an aorta than its coats grow hard, ſtrong, muſcular, fit for its office, while thoſe of the veins from which it is formed are pellucid, delicate, and very tender. The aorta is full of the oxydated blood of the gills; and although, by the delicate circulation of the gills, it has loſt all communication with the heart, it circulates this oxydated blood through the body to all the muſcles, glands, viſcera, &c. without the intervention of a new heart.

The veins which return the blood of this aorta are the ordinary veins; they arrive in two great branches at the heart, and need not be further explained.

I will not be at the trouble to repeat the tedious calculations of authors concerning the immenſe ſurface which the gills expoſe: Let the ſtudent look to the gills, and he will preſently, with the help of this ſhort ſketch, underſtand how the whole function goes on.

No 1

FIFTH SPECIES OF RESPIRATION,
VIZ. THAT OF INSECTS.

There is in this kind of reſpiration no breathing organ like the lungs, but tracheas or air-tubes by which air enters into all parts of their body.

What is moſt perplexing in this ſpecies of reſpiration is the prodigious quantity of air which theſe creatures receive; the little connection betwixt the air-tubes and the heart; the impoſſibility of tracing blood-veſſels from the heart to the various parts to nouriſh them; and the clearneſs with which we ſee their air-tubes branching over all parts of their body. The ſtomach, bowels, and other viſcera, the legs and wings, even the very ſcales of inſects, have branches of the air-tubes dividing over their ſurfaces like the delicate veſſels of leaves and flowers. In ſhort, the magnitude of theſe air-tubes is quite ſurpriſing; and their branchings are ſo minute, delicate, univerſal over all the body, that it looks almoſt as if the air-tube had exchanged functions with the heart and arteries.

It is plain by theſe expreſſions of admiration that I do not mean to attempt ſo difficult a ſubject as this at preſent: I only mention difficulties which it is ſurpriſing that others have not declared and inveſtigated, for nothing can be more intereſting. The little that we do know ſhall be ſimply and plainly told.

The forms of inſects are often very ſtrange, their lives very irregular, ſometimes in water, ſometimes in air; many of them begin in worms, and end their lives as Flies and Moths; and according to theſe varieties of their form, or life, or generation, their air-tubes are various.

Sometimes, as in the common Bee, they have nearly the form of lungs: They begin like two bags, reſembling thoſe of the Alga Marina, or ſea-weed, in ſhape; and theſe bags diſtribute pulmonary tubes, with occaſional bag-like dilatations in the courſe of the tubes, through all the body. More commonly the air-tubes of inſects are direct tubes, mere tracheas, of a very ſingular conſtruction; they have rings like the tracheas of animals; they have a delicate membrane covering theſe rings and forming them into a tube: the tube continues always rigid like a flexible catheter, or other tube of twiſted wire not liable to collapſe: They begin by many open mouths opening along the ſides of the inſect, and they

they terminate in myriads of veſſels, which, in their forms and progreſs over the various parts of the body, reſemble blood-veſſels more than it is eaſy to conceive. Theſe air-tubes being thus rigid, are always full of air, and by their refractions through the tranſparent parts of the inſect's body they give it in the microſcope a great degree of brilliancy; as for example in the Louſe, whoſe air-tubes make the brilliant lines and points which are contraſted like a ſilvery colour with the dark and opaque parts; or in the Mite, which is as beautiful in the microſcope as the Louſe; and when the larger inſects are prepared by drying and varniſhing, and preſerved in turpentine, the air-tubes are beautiful. Of theſe curious particulars, the openings of the air tubes are beſt ſeen in the Worm from which the common Butterfly is produced; we count theſe holes down the ſides, we name them puncta reſpiratoria, ſpiracula, or moſt commonly ſtigmata; (Vide figure 1.) Their tranſparency and brilliancy is well underſtood from the view of the microſcope Louſe, (figure 2.)

That particular form in which they reſemble more the lungs of animals is ſeen in the pulmonic bags (*aa*)—and the tracheas or air-tubes (*bb*)—of the common Bee, (figure 3.) Their exquiſite branchings through the various parts are well ſeen in the drawing of the air-tubes which run along the wings of a Bee (figure 4.) or thoſe which twiſt and ramify round the inteſtines and

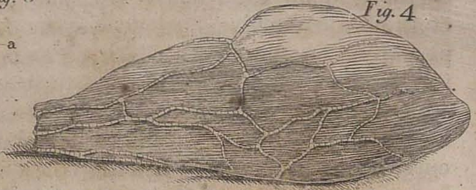
Air Tubes

J. Bell sc.

stomach of a Worm; and it is not to be forgotten, that though the beginnings of these tubes in their great tracheas and near the puncta respiratoria are quite transparent, their extreme branches are beautifully white like vessels filled with chyle, or rather one might be apt to mistake them for nerves.

Fig. 3

Fig. 4



Of the way in which this function is performed, there must be more varieties that we can know or comprehend: this we may safely conclude from the little that we do know, finding the variety so very great.

Almost all insects have their puncta, like those of the Caterpillar, ranged along the side, and inosculating like those of the Louse from branch to branch: often the puncta open along the sides; but in place of inosculating from branch to branch, all round one side, they inosculate across the belly, the one side communicating with the other. This is best observed in the small Worm from which the Bee proceeds (vide Fig. 6.), which is a magnified drawing of the Bee-worm. And here it must be observed, that, as in other insects, always the stigmata or breathing points correspond neatly with the folds or rings while it continues a Worm, and with the scales or divisions of the body when it becomes a Fly; in the Bee-worm also the inosculations answer to the flexures or joints of the body.

Often when the insect lives in water, it has only two puncta respiratoria: these puncta begin either in the snout or in the tail; they are the openings of two great air-tubes which run down each side of the insect like two aortas, and the insect has means of rising to the surface, takes down a bubble of air along with it, and discharges a bubble of air before it rises again; of this nature are the

the air-tubes of that Worm from which the Ephemeris proceeds. The ſketch of the Ephemeris and its air-tubes is given in figure 7.—This Fly has but two ſpiracula; they are ſo ſmall towards the neck, where their commencement is, that their mouths cannot be eaſily found. The two great air-tubes (*aa*) are ſeen like two aortas running all along the body, and their minuter branches (*bb*) are ſeen ramifying beautifully upon the abdominal muſcles and other parts. Many inſects are aquatic when firſt they are hatched from the egg. They have little gills which ſerve them while they continue in the water, as, for example, the Ephemeris Fly; but along with theſe gills they have the ordinary ſtructure of air-tubes, and the day on which they emerge from the water, the gills ſhrink, and the air-tubes begin their function; and theſe changes ſucceed each other very rapidly in all inſects, but moſt eſpecially in the Ephemeris, which is deſtined to live but one day.

It is moſt of all ſingular, that in ſome inſects the number of reſpiratory points, or puncta, changes according to the various conditions or ſtages of their exiſtence. For example, a Worm which crawls among the duſt, ſince it muſt breathe leſs eaſily, has more puncta than when it has changed its ſtate to that of a Fly, and has its puncta very freely expoſed to the air: in the Rhinoceros Beetle the Worm has more puncta reſpiratoria, and cloſer, becauſe it crawls on the ground amidſt mud or duſt; they are leſs numerous in the Fly, as its air-holes are always more freely expoſed; and when the Beetle is actually flying, thoſe puncta which were cloſed by the caſes of the wings are fully opened; ſo that the inſect breathes more freely, and perhaps its body is lightened, ſo that it flies more eaſily: it is alſo particular, that in the full-grown Beetle, though the puncta be leſs in number, the lungs are enlarged, they both change their form and become more capacious; for the tubes are mere tracheas or ſtraight lines, with direct branches in the Worm, but in the Beetle they are dilated from point to point into air-bags.

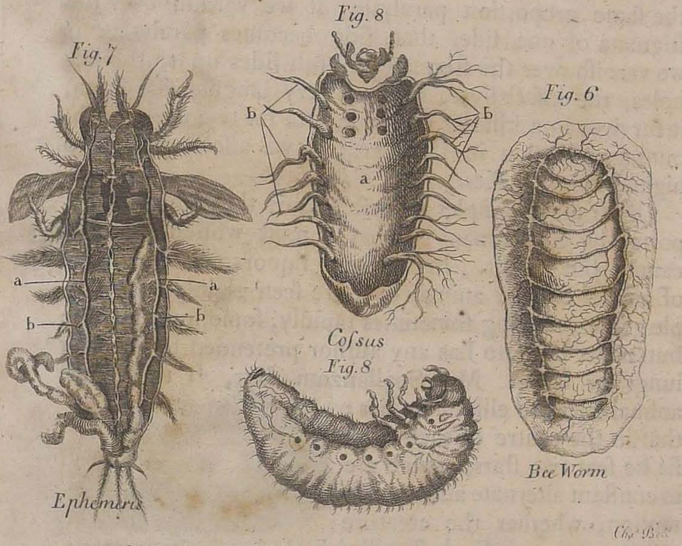
Inſects in general are bred in eggs, transformed into worms;

worms, aſſume then the form of an aurelia, that is, of a Fly, ſmall but full formed, with its legs drawn up, its wings plaited and folded, ready at all points to burſt from the covering which ſurrounds it; for both in poſture and in the membranes which ſurround it, it reſembles a fœtus. In theſe three ſtages it ſtill is nouriſhed by air-tubes: they open by puncta reſpiratoria while it remains a Worm; the ſame puncta ſtill ſerve it while it is wrapped up an aurelia or concealed Fly; when the Fly burſts out, the ſame puncta, the ſame tubes, which have ſerved in its former ſtages, ſerve it ſtill; only this is moſt curious, that when from a Worm it proceeds a Fly, the ſkin which it rids itſelf of (crawling out of it and puſhing with its feet) carries off along with it many of the internal parts; the mouth, the anus, and eſpecially all the reſpiratory tubes, loſe an internal ſkin, at the ſame time that the old ſkin or ſlough is puſhed off from the outward ſurface of the body; and when the puncta are thus changed, they are left more open than before, and often their number is changed. For the drawing of this ſlough or ſkin (*a*)—from which the Worm has juſt diſengaged itſelf, and the old air-tubes (*b*)—inverted, and adhering to the caſt ſkin, ſee figure 8. which is the figure of the Coſſus, an affected name by which Mouffet and others have choſen to diſtinguiſh the Worm from which the Horned Beetle proceeds.

Theſe are the various ways by which inſects are ſupplied with air; and nothing can be more intereſting than to obſerve the vaſt proportion of air which they draw in, which is certainly a proviſion for their living in places where oxygene cannot be plentifully ſupplied. And the fact is well known, that inſects can live on air much leſs pure than what is neceſſary to breathing creatures, and that they exhauſt the oxygene of the atmoſphere much more completely than any other living creature. The variety in the manner of conducting the air to the ſyſtem of inſects is changed, and ſuited, as I have obſerved, to their various ways of life, and to the various conditions and ſtages of their life; while they are Worms, when they are involved fœtuſes, and when they have

burſt

burſt their ſhell and are full grown. In ſhort, Worms, Aureliæ, Flies, Beetles, Bees, and all forms of inſects, have all of them their tracheas by which they breathe a wonderfully large proportion of air.



There can be no miſtake concerning the function of their air-tubes and of their heart; it is ignorance or inattention only that can cauſe confuſion; the heart of a Caterpillar, of a Snail, of the Worms from which various Flies are produced, are ſeen diſtinctly through their tranſparent body, running down their back in form of a tube, ſometimes ſlightly oval, ſometimes having frequent dilatations, and throbbing, though with leſs equable and diſtinct pulſes than in the more perfect animals.

Nor can there be any miſtake that it is air they breathe; for before we diſſect an inſect, we muſt kill it; the contortions of a live Caterpillar prevent all deliberate diſſection, or even a view of the parts; we may poiſon the inſect, as with turpentine or ſpirits; we commonly drown it: this is done by immerſing it in a little tepid water.

water. Nay, we find a thing which is at firſt inconceivable to be really true, that notwithſtanding the inoſculations of the air-tubes with each other, which ſeems to provide againſt all ſuch effects, when we cloſe up the ſtigmata of an inſect one by one, the parts become in the ſame proportion paralytic; if we varniſh over the ſtigmata of one ſide, that ſide becomes paralytic; if we varniſh over the ſtigmata of both ſides up to the laſt holes, the inſect lives, but in a very languid condition, it ſurvives in a kind of lethargic ſtate for two days, without any pulſation in its heart; if we alſo ſtop the two higheſt holes, it dies.

Of all the examples of reſpiration, that which is reported by Spallanzani is what I moſt wonder at, and cannot but doubt. In aceſcent liquors, or the juices of animal bodies, animalcules are ſeen plainly with ſimple glaſſes, moving ſometimes rapidly, ſometimes ſlowly; but never hitherto has any author pretended to ſee their lungs or heart. Mr. Spallanzani ſays, "that theſe animalcules are elliptic bodies; that in the centre of each ellipſis he ſees two ſtars, which are in conſtant alternate and regular motion, whether the creature

reſts or moves. Each ſtar-like body has in its centre a ſmall globe, and every three or four ſeconds the globules are blown up ſlowly to three or four times their natural ſize, and as ſlowly compreſſed again; and every time that the radii are inflated the central globule ſubſides. On one ſide of theſe ſtar-like bodies there is an oval part, which is continually agitated with a trembling motion; he calls the ſtar-like bodies lungs, and the oval body he thinks is the heart." Spallanzani ſurely has forgotten that he is ſpeaking of lungs in an aquatic inſect: if theſe ſtar-like bodies have any ſuch uſe, they muſt be gills.

Theſe are the animalcules which Buffon called organic germs, and from which, as materials and pieces, he built up the animal body. But if all this be true, then the day is come which he little expected, when the organic particles, on the faith of which he built all his

Plans of the Diaphragm

No. 1
Shewing the Place and Form of the Diaphragm
No. 2
Shewing the Effects of its descending & ascending alternately

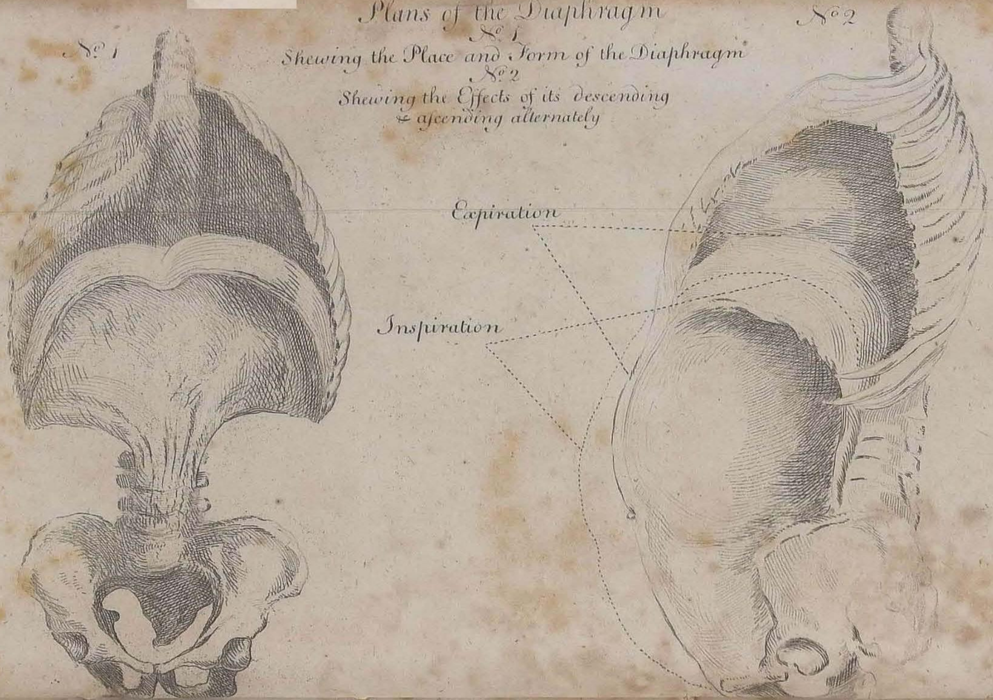


Fig. 2

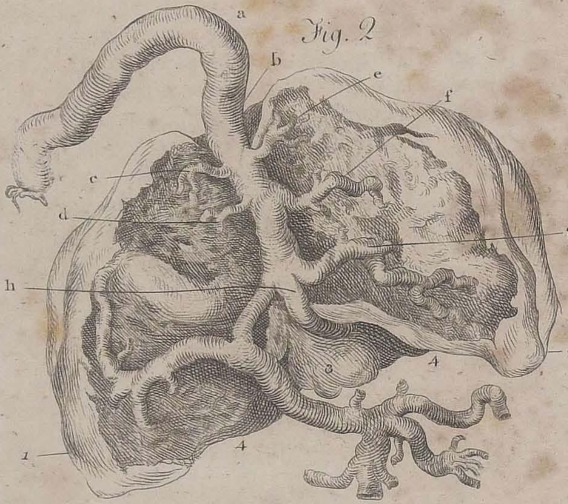


Fig. 1

Vena-Cava-Abdom:

his ſyſtem of generation, are proved to be living and moving animalcules, voracious of food, devouring each other, breathing air, and having a viſible pulſating heart; animalcules depoſited from the atmoſphere, and generating like other inſects of their kind.

Thus we are convinced of the importance of reſpiration, and the abſorption of air in all living creatures, from Man even to the meaneſt reptile; and not leaſt needful in the laſt and loweſt order, which receive in proportion a fuller ſupply of air than fiſhes, amphibiæ or Man.

CHAP. IV.

OF THE PECULIARITIES IN THE CIRCULATION OF THE FŒTUS.

THE peculiarities of the fœtus all relate to the oxydation of the blood, and are ſuch chiefly as fulfil the circulation of the blood without any need of its paſſing through the lungs, enabling the fœtus to live without that function in its mother's womb.

1. We are aſſured that the blood which comes to the fœtus through the umbilical vein is pure, or of greater value than that which the fœtus returns to the mother's ſyſtem. Either this blood is reſtored to all its properties merely by paſſing through the mother's ſyſtem, and what is thus drained off from the extremities of the mother's ſyſtem is more than ſufficient for the life of the child; or, without ſuch direct communication, the placenta performs to the fœtus a function equivalent to that of the lungs. Then this blood, whoſe value and properties muſt be loſt, if puſhed through the circulation of the liver, paſſes only in part through the liver, while a chief ſhare of it goes by a ſide paſſage, which is called the DUCTUS OR CANALIS VENOSUS, under the liver, directly to the heart *.

* *N. B.* The canalis venoſus is marked in the plan.

2. This

2. This blood does not paſs through the circulation of the lungs; perhaps it ought not to paſs; for there being no reſpiration, no air admitted to the lungs, the blood might rather be contaminated; perhaps it cannot paſs, the lungs never having been expanded with air: but, however that be, there is a ſide paſſage for conveying it from the right to the left ſide of the heart clear of the lungs. For this uſe is the FORAMEN OVALE, which is an opening of no inconſiderable ſize betwixt the right and left auricle of the heart; its area is as large as that of the vena cava; and it is ſufficient, without the help of the ductus arterioſus, to convey the blood freely from right to left.

3. The DUCTUS ARTERIOSUS ſerves quite another purpoſe; for though the circulation of the aorta is well maintained in the adult body by the force of one ventricle only, yet in the fœtus one ventricle will not ſuffice. In the fœtus the heart muſt puſh its blood not only through that ſyſtem of veſſels which is within the body, but alſo it muſt puſh it onwards through a ſecond circle of veſſels, viz. thoſe of the placenta; for the iliac arteries do not deſcend into the thigh and pelvis of the fœtus, but the iliac artery itſelf, with little diminution (very ſmall branches only being given downwards into the pelvis and thigh), turns upwards along the ſide of the bladder; and theſe two arteries going out from the navel, form the umbilical cord; and the heart of the fœtus has to give life and action not only to its own internal ſyſtem, but to theſe two arteries comprehending the chief bulk of the aorta, which run out to the diſtance of three feet along the umbilical cord, and which make wonderful convolutions in the placenta, and terminate with extreme minuteneſs upon its ſurface. It is this which occaſions the neceſſity of the ductus arterioſus, which is merely a union or inoſculation of the pulmonic artery with the aorta. This union is formed by a great branch of the pulmonic artery in the fœtus, joining the aorta below its curve. This great branch (for it is greater than the two branches which go to the lungs) is named the ductus arterioſus, and may be defined an inoſculation

oſculation betwixt the pulmonic artery and the aorta, ſo very large, that it gives the aorta of the fœtus twice its natural ſize and proportion, and enables the blood of that artery to have the full force of both ventricles; of the left ventricle through the aorta, and of the right ventricle through the ductus arterioſus by one ſynchronous ſtroke.

4. The contaminated blood of the fœtus muſt be returned to the mother, or at leaſt to the placenta; for which purpoſe the two iliac arteries are reflected along the ſide of the bladder as I have juſt explained. I ſay the iliac arteries without reſerve, becauſe the hypogaſtric and femoral arteries, that is, the arteries of the pelvis and thigh, though they are the largeſt branches of all the body in the adult, are in the fœtus extremely ſmall; and thence that ſmallneſs of the lower extremities compared with the largeneſs of the head, which characterizes the child, and which it takes years to redreſs.

DUCTUS VENOSUS.

Thus have I defined theſe parts and their uſes, in order that their ſtrict anatomy may be the more eaſily explained; and the part firſt mentioned, viz. the ductus venoſus, is the part the moſt difficult to be underſtood, and never without the help of a plan. In my plan I have endeavoured to elucidate theſe points.

Firſt, the mere anatomy, connections, and inoſculations of the veſſels; ſhowing how the umbilical vein brings in the blood of the mother; how that vein ſpreads in the liver and feeds all its left ſide with blood; and how the ductus venoſus carries part of that blood away from the circulation of the liver, conducting it directly onwards to the right ſide of the heart.

Secondly, I have endeavoured to explain what parts of the liver each branch ſupplies, and how theſe veſſels lie in the liver of a new-born child.

Thirdly, I have contraſted with this the change of form in theſe ſame veſſels, when, as happens in the adult, the form of the liver is changed, and the ductus

venoſus and the umbilical vein are obliterated, and gone, or converted into ligaments of very trivial uſe or ſize.

The blood from the maternal ſyſtem tranſmitted through the placenta, and oxydated, or having undergone ſome change equivalent to oxydation, comes down along the umbilical vein:—the vein enters by the navel, adheres to the inner ſurface of the abdomen, enters into the liver at the top of that great tranſverſe cleft which divides the liver into two lobes; and after entering the liver, it begins, as if it were the regular and peculiar veſſel of the liver, to diſtribute branches through its ſubſtance from right to left.

In figure 1.—(*a a*) ſhows the umbilical vein.—(*b*) the point at which it enters the liver—(*c*, *d*, *e*, *f*,) branches given to the ſubſtance of the liver, till at laſt it gives off (*g*)—a very great branch, which is indeed the chief trunk for the left ſide of the liver; it branches out in the liver like the oppoſite trunk, (*m*)—But I cut it off ſhort, leſt it ſhould confuſe the plan. Next comes (*h*)—the ductus venoſus, whoſe office is important, but whoſe ſize is not quite what we ſhould ſuppoſe. It comes off direct from the umbilical vein; its courſe is ſhort, and a little curved; it joins at (*i*)—the largeſt of the hepatic veins, *i. e.* of thoſe great veins which return the blood from the liver, and along with it goes directly into the right auricle of the heart, which is marked (*).—This, perhaps, might ſuffice as a deſcription of the ductus venoſus; but it is convenient, and will make a clear ſubject, to finiſh that circulation of which this ductus venoſus is one of the chief difficulties.

This I conſider as the end of the umbilical vein, for here its circulation ends; or, if it ſends blood into the right branch of the vena portæ, its proportion is but ſmall. But the VENA PORTÆ (which is juſt the collection of all the abdominal veins into one trunk,—of the ſplenic vein (1)—of the meſenteric vein (2)—of the hemorrhoidal vein, *i. e.* the vein from the pelvis (3);—the vena portæ, I ſay, compoſed of all theſe veins, is the true vein of the liver.

The

The branches of the vena portæ are gathered into a trunk at (*k*)—that trunk enters the liver at (*l*)—it divides into two great tranſverſe branches at (*m*) and (*n*)—the one ſerving the right ſide of the liver and the other the left; but in the fœtus this left branch (*n*) is not known as the limb or left branch of the vena portæ; but looks rather like the right branch of the umbilical vein; indeed, it is named ſo by Mr. Bertin.

But that I may not convey vague uncertain notions of veſſels apart from the organ which they are to ſupply, I have in figure 2. laid theſe veſſels upon an outline of the liver; by which I am ſure to explain correctly, 1. How the umbilical vein (*a*) enters at (*b*) into that great longitudinal cleft which parts the liver into two lobes. 2. How it begins, as if it were the peculiar veſſel of the liver, to diſtribute its branches (*c*, *d*, *e*, *f*,) from right to left. 3. How the laſt great branch (*g*) of the umbilical vein is the left trunk for ſupplying the left ſide of the liver with blood. 4. How the ductus venoſus (*h*) goes off in the moſt direct manner from the umbilical vein, and the faireſt for receiving its full proportion of blood; and how it carries that blood directly onwards to the back of the liver, or that part which touches the diaphragm, and there the ductus venoſus enters the heart *.

But my third plan explains the adult liver as if theſe branches had never exiſted. The two firſt plans ſhow what are its veins in the fœtus. This third plan ſhows what are its proper and permanent veins; for thoſe peculiar veins which we find in the child are accommodations for the fœtus, are ranked among the peculiarities of the fœtus, and are, when the child is born, obliterated by a new circulation; and what is very curious,

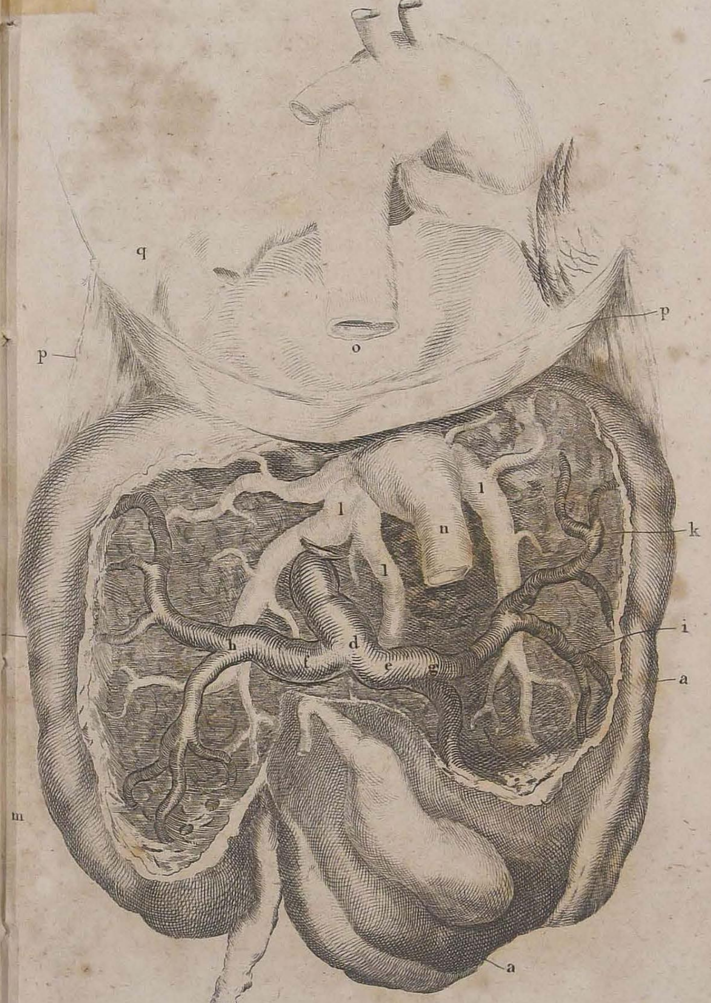
* The lobes of the liver in figure 2. are marked thus:—(1) The great right lobe—(2) The great left lobe—(3) The little lobe, or Lobulus Spigelii, lying betwixt them; and it ſhould be remembered, with regard to the poſition of the liver in this drawing, that it ſtands upright, as if pulled up by pulling at the umbilical vein (*a*)—or at the round ligament, which is the ſame thing (for the vein is converted into this ligament), ſo as to bring it into a perpendicular poſture, and ſhow the back line of the liver (4, 4)—where it touches the ſpine and diaphragm.

by a circulation which goes through the ſame veſſels in a retrograde courſe.

In this third plan I repreſent the liver of the adult; I conſider only the vena portæ, which is its proper vein, and I give the vein and the liver itſelf in a new form. This plan is drawn from an adult liver, moſt of its ſubſtance being diſſected away.—(*a*) Marks the right lobe—(*b*) the left—(*c*) the lobulus Spigelii. Theſe are ſufficient to mark the more important points, and I have not ſpared the ſubſtance of the liver in other parts where veſſels were to be ſhown.—(*d*) Is the ſhape of the vena portæ tied after injection, and cut ſhort and twiſted a little ſo as to make it ſtand almoſt perpendicularly—(*e*) and (*f*) are the two great lateral branches going to the right and left ſides of the liver; and this cylindrical part of this very great vein is called the ſinus of the vena portæ. It is ſo formal, lies ſo fairly at right angles with the vena portæ, goes ſo regularly into two equal limbs, the branches too, even when ſpreading in the liver, are ſo formal, that it looks more like a piece of human mechaniſm than any thing belonging to the living body: it appears ſo here, not from the ſtiff and awkward forms which a plan muſt have, but becauſe it is thus in nature. The right branch (*g*) is diſtributed very formally to the right ſide of the liver:—(*h*) The oppoſite branch is diſtributed as formally to the left; and there is no mark or note by which it can be known that this left branch had ever proceeded from the umbilical vein, or been filled by it, or been any thing but what it now appears, the left branch of the vena portæ correſponding moſt regularly with the right. And in the ſame way it may be obſerved, that the middle veins of the liver (*i*, *k*, *l*, *m*,) are now plainly known to be legitimate branches of the vena portæ, though they appeared in the fœtus to be proper branches of the umbilical vein: they are named ſo by Bertin and others, the beſt anatomiſts; but that they are plainly not ſo, becauſe the umbilical vein (ſince theſe branches go off at an angle) filled them only by a backward courſe, while here in the adult they are filled

by

Third Plan of the Liver



[...]s the Vena Cava Abdominalis o is the place where the Cava enters the right [A]uricle p is the Diaphragm upon which the right Auricle lies and the heart & [...]ssels are seen above the Diaphragm q being the apex of the heart

by their natural trunk, the vena portæ, in a more natural way.

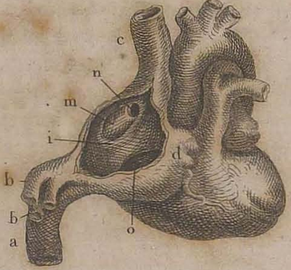
Now, by glancing the eye from the circulation of the fœtus to that of the adult, we obſerve theſe changes: Firſt, The liver of the fœtus has blood circulating in two directions; the right ſide of the liver is filled from the vena portæ, the left ſide by the umbilical vein. The liver of the fœtus having two veins has a large quantity of blood, a growth larger than that of any of the viſcera; and indeed the liver alone ſeems to fill all the upper region of the abdomen. This is changed when the child is born; the umbilical circulation is cut off and the liver of the child ceaſes to grow but in proportion to the other parts *. Next, we obſerve in the fœtus how the umbilical vein runs into the left branch of the vena portæ, inſomuch that the left branch of the portæ has not any determined form; nor has the ſinus vena portæ, or the horizontal ſhaft of this vein, that peculiar and formal ſhape which I have already obſerved. This ſhape, then, of the ſinus venæ portæ, is not to be looked for in the child, and is not found in theſe plans.

Again, we find in the adult thoſe blood-veſſels obliterated which ſerved ſuch peculiar uſes in the fœtus; the blood which flowed formerly into all the left ſide of the liver by the umbilical vein now comes along the venæ portæ; theſe veins are now working their blood in a retrograde courſe; the blood which flowed once in the direction (*i*) N° 2. runs now in the direction (*k*) N° 3.

In this plan are ſeen alſo the hepatic veins, or branches of the vena cava, in the liver. Theſe three great veins marked (*l l l*)—are the returning veins, which carry back to the heart that blood which the venæ portæ (aſſuming the office of an artery) circulates in the liver; and it is with one of theſe that the ductus venoſus joins before it enters the heart.

* One is forced to ſpeak this unphiloſophical language, though the ſize of the liver in the fœtus is as juſt and well proportioned to the fœtus, as that of an adult body is to an adult body.

Plan of the For: Ovale



FORAMEN OVALE.

THE foramen ovale, the ſecond peculiarity of the fœtus, is a hole of no inconſiderable ſize, tranſmitting the blood freely from the right to the left ſide of the heart. Its uſe is obvious, even from a general view of the ſyſtem; and when we look more cloſely into its mechaniſm, its uſes are completely explained. Its valve being placed on the ſide of the left auricle, perfectly ſettles (and that by the only authentic proof) the courſe of its blood: and, ſatisfied with the deſcription which I am now to give, I decline all diſputes about the nature of this opening, or its valve. This is a ſubject which diſputes may perplex, but cannot explain. Another reaſon which I have for declining ſuch controverſies, is this: It is an eaſy matter to impoſe upon a whole academy, eaſier by far than upon one ingenious

EXPLANATION of the PLAN of the FORAMEN OVALE.

(*a*) The aſcending cava, with its hepatic branches (*b b*)—(*c*) The deſcending cava.—(*d*) The right auricle, where it lies againſt the roots of the aorta and of the pulmonic artery—(*i*) The iſthmus Veuſſenii, as it is called, or circle which ſurrounds the oval hole—(*m*) The valve of the foramen ovale—(*n*) A ſmall opening, which we always find towards its upper part—(*o*) The opening towards the ventricle.—This plan is intended chiefly for ſhewing the true place of the foramen ovale; its anatomy and juſt form is better repreſented in the true drawing which ends this ſubject.

man:

man: and thus it came to paſs that in the French Academy each theoriſt brought diſſections of the heart and foramen ovale ſuited to his own doctrines; each, when convenient, changed his ground a little, and brought new diſſections; and thus valves and auricles, fœtal and adult hearts, double Cats and human monſters, made their annual exhibitions in the halls of the French Academy: the Society never ſickened nor tired, and the raree ſhow laſted exactly one hundred years.

What kind of doctrines were current at ſuch a time it is almoſt ſuperfluous to explain; yet I think it not amiſs to remark two examples, of obduracy on the one hand, and of ingenuity on the other, in two of the greateſt men. Mr. Mery had conceived notions about the circulation of the blood in the fœtus, which can hardly be explained *; but it was one point eſſential to his doctrine, that the blood in the fœtus moved directly from the left auricle to the right. He was forced to deny that the foramen ovale had a valve; and this doctrine he continued, with many quirks and tricks, to maintain to his dying day. Mr. Winſlow agreed with Mery; he ſaid, that the foramen ovale had no valve; that though it had a membrane, that membrane performed nothing of the office of a valve; that the blood paſſed freely from right to left, or from left to right, as occaſion required; that thus the two auricles were as one. He forgot for a time that there is but little circulation in the fœtal lungs; that the right auricle is filled with all the blood of the body, while the left is filled very ſparingly by the pulmonic veins. From theſe data it is plain, that the balance muſt always be in favour of the right auricle; that it always muſt be more full of blood; that without ſome valve the blood muſt ruſh with a continual preſſure from right to left; while, again, the place of the valve is itſelf a demonſtration that the

* All that can be done towards the explaining it in one word is this: He "fancied that the right cavity of the heart was ſo large and the left ſo ſmall, that always the left ſide was obliged to diſgorge again upon the right ſide; and this was the meaning of the blood ruſhing through the foramen ovale from the left ſide to the right."

blood cannot paſs from left to right. Winflow, when he ſome years after perceived that he had ſpoken idly upon this ſubject, left Mr. Mery among his fooliſh arguments and diſſections, and retracted all that he had written, with a manlineſs of ſpirit which deſerves to be recorded.

The foramen ovale is not ſtrictly oval, but is rather round. In the plan it appears oval, becauſe there I have endeavoured to repreſent the condition of the veſſels when the heart is dilated and the veſſels full; but when we lay it out for demonſtration or for drawing, it appears, as in the drawing, of a rounded ſhape.

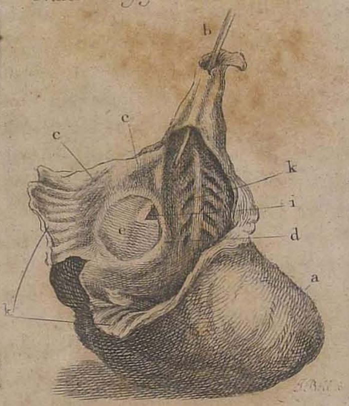
The oval hole is in the partition betwixt the two auricles at its very backmoſt point; for, in fact, the auricles touch each other only behind; at their fore-part they are ſeparated by the roots of the aorta and pulmonic artery, as may be ſeen in any of the plans. We look, then, for the foramen ovale at the very backmoſt part of the right auricle; or rather it is placed ſo high in the auricle as to ſeem to belong rather to the root of the cava deſcendens.—A ring riſes round the borders of the hole, very prominent, and exactly like the ring of the meatus auditorius internus in a child.—This was named ISTHMUS VEUSSENII; but this conceited name of iſthmus, Veuſſens gave it, is quite unintelligible, and it muſt be changed for that of the CIRCULUS FORAMINIS OVALIS, the ring or circle of the oval hole.—This circle is thick at its edges; very ſtrongly muſcular, like the muſculi pectinati of the auricle; in ſo much that authors of ſome character have thought this a ſphincter for the oval hole. There is no doubt a kind of decuſſation of the fibres at each end of the oval hole; ſo that theſe fibres, forming a ſort of pillar on each ſide or edge of the foramen, the name of Pillars of the Ring, or COLUMNÆ FORAMINIS OVALIS, is leſs exceptionable; though theſe pillars, or any thing deſerving ſuch a name, will not be eaſily found by one beginning anatomy.

The valve of the oval hole lies entirely on the left ſide, as the round edges of the right ſide may demonſtrate. By taking the blunt probe, we find we can lift it

it towards the left ſide; but being puſhed towârds the right ſide, it riſes into a ſort of bag, and oppoſes the probe. The valve is perfectly tranſparent; it ſeems delicate, like all the other membranous valves, but is really ſtrong. There is often left, after the cloſing of the valve, a ſmall opening at its upper part. The valve cloſes ſoon after birth: the hole is ſo large, that this membrane forms a very large ſhare of the partition betwixt the auricles; its tranſparency is ſuch, compared with the reſt of the walls, that it is as diſtinct in a boy, or in an adult, as in a fœtus.

This is the anatomy of the oval hole, and of its valve; and this proves, and any one who examines it will entirely be convinced, that the blood of the fœtus paſſes through it from right to left *.

True Drawing of the Foramen Ovale.—



* This heart of a fœtus had all its parts cut away, except the ventricles (*a a*)—the vena cava, with a blow-pipe in it (*b*)—and the wall or partition betwixt the auricles (*c c*)—which is here unfolded, to ſhew the foramen ovale. The muſculi pectinati, or muſcular fibres of the auricle, are well ſeen at (*k k*)—(*d*) Is the annulus foraminis ovalis.—(*e*) Is the valve itſelf.—(*i*) Is the ſmall opening in the upper part of the valve, where the valve falls ſlack, and ready to open.

DUCTUS ARTERIOSUS.

THE ductus arterioſus I have defined a great inoſculation betwixt the pulmonic artery and the aorta; not for the purpoſe of conveying away that blood which ſhould paſs through the lungs, but for giving to the blood of the aorta the propelling power of both ventricles: and how well it is able to perform this office, will be eaſily ſeen from the drawing on my margin *.

Ductus Arteriosus

The pulmonic artery of the adult divides, as has been marked in all my former plans, into two great arteries, one going to the right ſide, another to the left; but in the fœtus there ariſes a middle branch betwixt theſe two. It is larger than both put together; it is in the middle, and ſo comes moſt directly from the heart; it goes in a ſtraight line towards the aorta, and joins with it immediately below the arch. This is the ductus arterioſus, the centre branch of the three branches into which the pulmonic artery

* This ſketch is taken from a little preparation made on purpoſe, where a quill was thruſt in ſo ſtrongly betwixt the ductus arterioſus and aorta, as to ſeparate them unnaturally, and leave a ſpace (*a*) betwixt them.—(*b b*) Marks the two ventricles—(*c c*) the place from which the two auricles were cut away to make every thing clear.—(*d*) the root of the aorta, known by (*e e*) its carotids.—(*g*) Is the root of the pulmonic artery—(*i*) the right and (*k*) the left pulmonic arteries—(*m*) the ductus arterioſus, or middle branch, running into the aorta—(*n*) the place where they join—(*o o*) the aorta increaſed in ſize by this addition.

N. B. This heart is but a very little under the natural ſize in a new-born child.

of

of the fœtus is divided. It is bigger than the aorta in the fœtus; it gives the full force of the right ventricle to the blood of the aorta, in addition to that of the left. In the adult it is so thoroughly obliterated, that by the most careful dissection we can show no other vestige of it than a cord-like adhesion of the aorta and pulmonic artery.

These, then, are the chief peculiarities of the fœtus *: but the conclusions which have been drawn from this mechanism are, as I suspect, very far wrong. But this I can in no shape prove, till I shall have first represented the real condition of the fœtal heart. First, then, let it be observed, that every drop of blood which comes into the system is, either by the powers of the placenta, or by communion with the mother's system, oxydated blood. —One part of this blood, indeed, passes through the circulation of the liver before it reaches the heart, while another passes more directly through the ductus venosus; but both are mixed, and the blood is all of one quality when it arrives at the auricle, in order to fill the heart, and to begin its course round the body. Now, since the blood is all of one quality, Nature could have no cause for dividing such blood into two portions; one to pass through the lungs, the other to pass over the body. She could have no motive for employing, as in the adult, two hearts. The design of Nature, plainly is, to prepare a double heart, and keep it in reserve for the circulation of the adult, but to use it in a single heart in the fœtus. And see how simply this is accomplished. The two auricles communicate so freely by the foramen ovale, that they are as one; the two ventricles both deliver their blood into one vessel, the aorta; and they are also as one. The blood arrives by the cavas, fills the right auricle, and in the same moment fills, through the foramen

* The umbilical arteries must be explained in another place.

ovale, the left auricle; ſo that the auricles are as one, and filled by one ſtroke; the two auricles act at once, and ſo the ventricles alſo are filled by one ſtroke; the aorta receives the blood of both ventricles at one ſtroke. So that, in the ſtricteſt ſenſe of the word, the fœtus has but one ſingle heart, the heart of the body (the function of the lungs being performed by the placenta, far from its proper ſyſtem); and when the function of its own lungs begins, then Nature, by the ſimpleſt of all mechaniſms, divides the two hearts, that they may perform each its peculiar function. Firſt, the flow of blood into the lungs deprives the ductus arterioſus of blood; and, ſecondly, this flow of blood coming round to the left auricle of the heart reſtores the balance, preſſes down the valve of the foramen ovale, and makes the partition betwixt the auricles entire. In ſhort, while the oval hole and ductus arterioſus are open, it is a ſingle heart; and when they cloſe, as they do the moment the child is born, it becomes the double or perfect heart.

Now the miſtake which all phyſiologiſts have fallen into is this, They have not obſerved that no creature can live with a ſingle heart, which has the oxydation of its blood performed by lungs. A fiſh lives by a ſingle heart, becauſe its blood is oxydated by gills, not by lungs: Inſects live with a ſingle heart, as their lungs, or the branches of their lungs, are diſtributed like arteries over all their body: The fœtus can live with a ſingle heart, becauſe its blood is oxydated by the placenta. And that this idea may make a more determined impreſſion, it will be good to prove, that the function of the placenta actually is equivalent to the function of the lungs; and that it is the placenta itſelf that produces this change upon the blood, I am the rather inclined to believe, becauſe we ſee the veins and arteries of the Chick ſpreading over the membranes of the egg, and we can obſerve the artery ſending dark-coloured blood into theſe membranes, while the vein brings back florid or oxydated blood.

If, during child-labour, the umbilical cord falls down before

before the head of the child, at firſt it is not preſſed but beats ſtrongly, and the fœtus is felt ſtruggling in the womb; but when, after a few pains, the head deſcends into the pelvis, the cord is preſſed betwixt the head and pelvis, the pulſe falters, ceaſes; the child ceaſes to ſtir in the womb; and if not born in a few minutes is irrecoverably dead, and is black in the face like one ſtrangled or drowned. When a child comes with its feet or other parts of the body firſt, the head being laſt delivered, is difficultly delivered; the accoucheur ſtruggles long in bringing out the head; the umbilical cord is compreſſed all the while, and the child dies. The ductus arterioſus, nor the oval hole, cannot ſave the child, for it dies becauſe it is deprived of the function of the placenta, which is the fœtal lungs; and this is the cauſe why it appears like one ſuffocated or drowned.

When the child is born, lay it upon your knee, the cord being uncut, and you will obſerve that the one function declines exactly as the other ſtrengthens. That if the child do not breathe freely, the cord will continue to beat ſteadily, the placenta ſtill continuing to perform the function of the lungs: That when the child begins to cry freely, the pulſe of the cord and the function of the placenta ceaſe at once. If the child breathe freely, but yet do not cry, and you tie the cord, it is inſtantly forced to cry for a fuller breath; and if a raſh perſon tie the cord prematurely, when the child neither cries nor breathes, he cuts off the function of the placenta before the function of the lungs is eſtabliſhed, and often the child is loſt: this, in the hurry and officiouſneſs of ignorant women, happens every day. If even after two days the child's breathing be much interrupted by coughing, crying, or any ſpaſmodic affection of the lungs, Nature ſeeks again the function of the placenta, and the pulſe returns into the cord ſo as to raiſe it from the belly of the child. Theſe things prove what the beſt phyſiologiſts have forgotten, or have not known, that the fœtus has, in the function of the placenta, ſomething equivalent to the function of the lungs.

One

One great miſtake then runs through the whole of phyſiology. It has been univerſally believed that the free and eaſy tranſmiſſion of the blood was the chief uſe of the lungs, as if they had acted like fanners to flap on the blood from the right to the left ſide of the heart. They affirmed, that either continued diſtenſion, or continued collapſe, hindered the progreſs of the blood; and they alſo believed univerſally, that if but the ductus arterioſus or foramen ovale, or any thing, in ſhort, were left open to let the blood paſs, that perſon might live in ſpite of hanging, drowning, or ſuffocation of any kind.

This will be found to be the moſt perfect of all abſurdities; and to alledge ſuch a thing againſt all authors requires ſome kind of proof; it will ſuffice, if I prove it againſt a few of the moſt eminent. So much were the older authors wedded to this miſapprehenſion of the dilatation of the lungs being uſeful only by driving forwards the blood, that, in the Pariſian diſſections, we find the following experiment made on purpoſe to prove the fact. "We have alſo made another experiment (ſay the Pariſian diſſectors *) to know more diſtinctly the neceſſity of the motion of the lungs for the entire circulation of the blood. An injection being made by the right ventricle of the heart into the artery of the lungs of a dead Dog, it happens, that if one continue to make the lungs riſe and ſink alternately by means of bellows put into his trachea, the liquor puſhed into the artery does eaſily paſs and go through the vein into the left auricle; but when one ceaſes to blow, it paſſes not but with a great deal of difficulty," (page 262.)—Which doctrine is dilated into its full abſurdity in the next paragraph. "Having viewed the difference of ſtructure in a Tortoiſe and in a Dog, it is eaſy to give ſome probable reaſon of the phenomena of theſe experiments; and the reaſon is, that it is neceſſary that theſe veſſels ſhall be

* *N. B.* This was a wheel within a wheel; it was a committee of the great academy, who were ſeparated into a ſmaller ſociety for inveſtigating the organization of all ſtrange animals; and a very pretty account they gave of them, as ſhall be ſeen preſently.

dilated

dilated for the receiving of the blood of the right ventricle of the heart, and that they may be afterwards compreſſed in expiration to preſs out the blood, and make it paſs into the left ventricle." Swammerdam indeed ſays, concerning the Frog's lungs, that an artery goes over them, which has no other purpoſe but to nouriſh the lungs; and that it is of the nature of thoſe called bronchial arteries in Man. But the College of Diſſectors have plunged ſtill deeper into this remarkable blunder; for they ſay (page 261.), in ſpeaking of the lungs of Newts, Frogs, and other creatures which I have repreſented as having a pulmonic artery extremely ſmall in proportion to their ſyſtem, "that in ſuch creatures the lungs have merely that quantity of blood paſſing through their ſubſtance which is neceſſary for their own particular nouriſhment;" which is ſaying in the plaineſt terms, that they have lungs (only, I ſuppoſe, that they may be like other creatures); but their lungs are of no manner of uſe, except to nouriſh themſelves.

One ſhould have thought that the folly of this opinion would have appeared more ſtriking in proportion to the earneſtneſs of theſe arguments, and that no ſubſequent author would have deigned to honour ſuch an opinion ſo far even as to notice it: but behold the celebrated Haller not only adopts this notion very fully, but enriches it with further explanations, ſaying, "that the veſſels are all, during the contraction of the lungs, forced into numerous angles and joint-like folds; that the angles are made even, and the paſſages of the blood more direct upon the expanſion of the lungs." As if, forſooth, the lungs (which, as I ſhall preſently demonſtrate, ſcarcely move in reſpiration) folded and cloſed upon each other like the wings of a Butterfly or Beetle *. Santorini alſo repreſents the veſſels of the lungs as thus collapſed, plaited, and folded a thouſand various ways "affaiſſé et replié de mille manieres differents, &c."— "One effect of expiration (ſays Haller) is ſo to com-

* "Præterea, in vivo animali, cujus cor contrahitur, et in arterias pulmonales ſanguinem data vi emittit, omnino nunc ſanguis in eas arterias facilius, atque adeo celerius irrumpit, poſtquam deletus retardatricibus plicis, recta nunc ſunt."

preſs

prefs all the arteries of the lungs, that they cannot receive the blood from the ventricle of the heart fo freely as they are wont to do *.

" It muft feem very ftrange for me, after faying that inflating the lungs reftores an animal after apparent death, and recovers the drowned, to affirm that long continued refpiration is fatal †: and yet we need not look long for the caufe of this; for during this long continued infpiration, much blood muft be gathered in the lungs, but none can get out ‡." Nothing is attributed, in his explanation, to the want of air, but all is attributed to the obftruction of the blood: yet if this were all, Amphibiæ would need no lungs, fifhes would need no gills, infects could need no air-tubes; for none of thefe affift the motions of the heart. Monro, who puts Haller to rights in every thing elfe, follows him in this. " In all amphibious animals, therefore," fays Monro, " every part of the body may receive a confiderable portion of blood, although the refpiration and free paffage of the blood through their lungs be interrupted," &c. (p. 21.) And the celebrated Blumenbach, the man moft admired on the continent for his Phyfiology, fays, at p. 80. " Poft extremam refpirationem redeunti per venas cavas fanguini via fueta in pulmones nunc collapfos præcludatur §.

Thus

* Verum alter effectus expirationis eft utique pulmonis arterias ita comprimere, ut ne pari facilitate fanguinem a fuo cordis ventriculo recipiant.

† " Paradoxum videri poffit, ab infpiratione fanguinis in pulmonem commeatum expediri: inflato etiam aëre, quod genus eft magnæ infpirationis, animalia moribunda revivifcere, et fanguinis per pulmones iter revocari: et tamen hanc eandem, adeo faventem fanguinis per pulmonem motui infpirationem, fola paulo diuturniori continuatione, anxietatem primo incredibilem facere, deinde, fi vel voluntatis violento imperio tamen aer in pulmone retineatur, vel ab alia caufa intra pulmonem copiofior fervetur, denique faniffimum et fortiffimum hominem fubito interire."

‡ " Hujus nunc anxietatis et fuffocationis, et denique mortis caufam non eft arduum invenire. Adparet enim, ab infpiratione diutius continuata, fanguinem in pulmonem quidem advenire, et congeri, exitum vero ex pulmone non invenire."

§ Mr. Keate, one of the lateft writers on the recovery of drowned perfons, has the fame notion. " We inflate and empty the lungs (fays

Thus I have proved, that it has been the opinion down to the present day, that the collapse or over distension of the lungs are both equally opposite to the easy passage of the blood: but instead of going round about the matter slyly, as some lesser authors have done, I like rather the manner of the Reverend Dr. Hales, who says plumply, "that suffocation consists in the falling flat of the lungs," (p. 271.) He talks in this way, because, like Buffon, Derham, Des Cartes, and some others, he was a philosopher by inclination, and by force a sort of an anatomist.

Now, the condition of the human lungs is quite opposite to all this; and also (in respect of distension) is less different from the lungs of reptiles than it is easy for any one bred up in the old doctrines to conceive.

In expiration the lungs do not even collapse in any sensible degree. Let us take for our data the common calculations concerning the quantity of air in the lungs, and let us see what they will do towards proving this opinion. The lungs are supposed to contain at the time of their utmost fulness about 220 cubic inches of air. When we continue breathing in a natural and easy way, we draw in and expel alternately about 40 cubic inches of air; but when we choose to force respiration, we find that we can expel without danger or harm 70 inches more; we can expel 110 inches of air, leaving only 110 inches remaining in the lungs. Now let us, for a moment, observe how little danger or distress it occasions when a forced respiration is made—such as is used in coughing, laughing, speaking, crying, expelling the child, urine, or feces, bracing up the body for the lifting of heavy weights, or other violent occasions, for which such forced respirations are by nature reserved. Let us notice how much forced respiration exceeds the ordinary respiration, and how small a proportion the

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(says he), in order by their expansion and contraction to FORCE the blood across from the right to the left side of the heart."—and he expresses himself as perfectly indifferent what kind of air be used, foul or pure is all one.

quantity of an ordinary breathing, viz. 40, bears to 220, the whole quantity of air within the lungs. Reflecting thus what large inſpirations of air we may take, and how very little we do take, we begin to perceive how gentle the motion of the lungs muſt be.

There remains always within the lungs a great maſs of air, which I will call the permanent dilatation of the lungs, which, from the firſt movements of the child, from the hour of birth till death, and even after death, muſt remain in the lungs. This maſs, equal to 220, cannot be entirely breathed out; even the utmoſt force of reſpiration expels but the half: this is never done but on extraordinary and moſt urgent occaſions, which do indeed diſturb the circulation; as coughing, laughing, crying, or running do. But this great maſs is ſeldom ſo moved; it is regularly and gently agitated by the change of 40 parts of the 220 which we expire and draw in again at each breath: we do not empty and fill the lungs at each breath; there is, on the contrary, a permanent expanſion of the lungs, and a maſs of air always in them; there is along with this a gentle and regular agitation; and there is changed at each reſpiration a ſmall proportion of this maſs of air. Our lungs are little different (in reſpect of, diſtenſion) from thoſe of Amphibiæ: for their lungs alſo, as I have deſcribed in the Frog, are permanently expanded, and at each reſpiration a little dilated and contracted; the air a little changed, a little moved, a little renewed; the change is in both caſes placid and gentle, and hardly to be perceived.

With theſe opinions concerning the ſtate of our lungs, nothing can appear to me more coarſe than the notion of their being entirely filled and emptied at each breath; nothing more ignorant than the ſuppoſing them to fall flat, as Hales expreſſes it, ſo as to hinder the motion of the blood: and the groſſneſs of this opinion appears in its true light when I put down this laſt proof, viz. that for each act of reſpiration there are four pulſes of the artery, or four ſtrokes of the heart. Is it not plain, then, to the meaneſt apprehenſion, that if the blood

5 moves

moves twice through the lungs in expiration, and twice during inspiration; or, in other words, if there be four strokes of the artery for each respiration, and if each of the four pulses be equally strong, that the blood passes through the lungs in all states and conditions with equal ease *?

It is also universally believed, and it is indeed a most legitimate conclusion, from this doctrine of the collapse of the lungs hindering the passage of the blood, that if but the foramen ovale or any passage be left open to let through the blood, that person will live without breathing.

It has been affirmed, that the Seal, the Beaver, the Otter, have the foramen ovale open. In the Seal, the Parisian dissectors found the oval hole open as in a child; but when they came to the foramen ovale of the Beaver and Otter, they found them, and sore against their will, quite close. In their disappointment they could have said any thing; but all that they thought prudent to say was, that the Beaver had not been in the water for a long while, not even to refresh himself †, and the Otter had been close penned up in his hut at Versailles; and so the foramen ovale had closed in these poor beasts quite close; and behold they were no longer Otters and Beavers, but little better than dogs ‡. Although Haller

* Their old and favourite experiment, so often repeated by Hooke, Croone, and others, before our Royal Society, viz. of blowing up the lungs of a Dog, and then compressing them, is good for nothing: for there the thorax is cut clean away; the permanent distension of the lungs is entirely lost; and then, no doubt, there is such a collapse of the lungs, as may, or rather must, hinder respiration; for the lungs are alternately distended to the greatest degree, and then emptied as completely.

† The Beaver sits in his hut just up to the hips in the water, and builds his hut so that he may sit just up to the hips.

‡ Cette ouverture, qu'on appelle le trou ovalaire dans le fœtus, fait l'anastomose par le moyen de laquelle le sang va de la veine cave dans l'aorte sans passer au travers du poumon; et c'est apparemment pour une même usage que ce passage se trouve dans le veau marin que dans le fœtus, à cause du besoin que l'un et l'autre ont de se passer de la respiration, sçavoir le veau marin pendant qu'il est plongé

Haller * declares that he had found the foramen ovale open in a man who was hanged; though Rœderer, Cheſſelden, and many creditable witneſſes, have teſtified the ſame; ſtill there has gone along with theſe confuſed doctrines about the foramen ovale a kind of dream (like that concerning the transfuſion of the blood), that if but the foramen ovale could be preſerved open, Man even might be made an amphibious creature. At firſt this notion began to peep through the miſts of this doctrine; and you might find an author, when he had diſſected a perſon with the foramen ovale open, inſinuating by oblique notions, what a vaſt pity it was that the man had not known, during his life, how kind nature had been to him, and what a perfect diver he was! while another ſays plainly, on a like occaſion, "what a pity it was that this child did not live!" we ſhould have ſeen almoſt an amphibious human animal, at leaſt a moſt notable diver †. On this ſlender ground they told the moſt wonderful tales, among which Pechlinus's ſtory of the Tronningholm gardener is one of the pretticſt. "The ice having broken, the gardener, in trying to help out ſome others, as frequently happens, ſlipt in himſelf into a place full eighteen yards deep. There he no ſooner touched the bottom, than he felt as if you had clapt a plaſter over his mouth; his feet ſtuck faſt, his body became rigid, and he ſtood there as ſtiff as a ſtake, with no one of his ſenſes about him, except only that he thought he heard all the while the Stockholm bells ringing moſt pleaſantly; and there he ſtood for ſixteen hours, the folks ſeeking him up and down, and wondering where he could be: at laſt having found him, they hooked him out with a pole; and after much warming, and

plongé dans l'eau, et le fœtus pendant qu'il eſt dans le ventre de ſa mere, où il eſt certain que les anaſtomoſes ſervent a décharger le poumon de l'abondance du ſang qui le ſuffoqueroit."—Vid. *Acad. des Sciences*, Anno 1699, page 149.

* Vol. II. Part 2. p. 11.

† Mr. Chemineau ſays, "On auroit vue avec étonnement un Homme preſque amphibie comme la Tortuë." Page 38.

rubbing, and working, and giving him hot drinks, they got his blood to circulate, and brought him to life again. He had ſenſe enough, however, he ſaid, to feel their hook; and indeed they had angled ſo ill, that his head was all bruiſed, and he had terrible headachs: but, however, the Queen-Mother gave him a good penſion, and he was ſixty-five years of age when Pechlinus wrote *." This is one of the many ſtories of men preſerved by the foramen ovale not having been ſhut. At firſt, I ſay, this opinion began to peep out in hints and reflections; then it ſtrengthened into wonderful tales of people being recovered who had been under the water ſix days; till at laſt a great genius undertook to make water-whelps upon a new principle, viz. with the foramen ovale open. This great genius was the Count de Buffon. Indeed even this very year a very celebrated author, Dr. Beddoes, forgetting, perhaps, how ſucceſsful Buffon is, tells us (page 41), that "by frequent immer-

* Hortulanus Tronningholmenſis etiamnum vivens, annos natus 65, pro illa ætate ſatis adhuc valens et vegetus, cum ante 18 annos alii in aquas delapſo opem ferre vellet, forte fortuna et ipſe per glaciem incautius procedens, aquas incidit 18 ulnas profundas: *ubi ille, corpore erecto quaſi ad perpendiculum, pedibus fundo adhæſit.* Conſtitit ſic per 16 horas, antequam produceretur in auras. Dixit autem, ſimul ac infra aquarum ſuperficiem fuit demerſus, *ſtatim obriguiſſe totum*, et, ſi quem tum habuit motum et ſenſum, amiſiſſe niſi quod ſonantes Stockholmii campanas etiam ſub aquis obſcurius percipere ſibi ſit viſus. *Senſit etiam, ſtatim ſeſe velut veſiculam ori applicaſſe*, adeo ut aqua nulla os penetraverit, in aures vero tranſitum, etiam ſentiente illo, habuerit; atque inde auditum ſuum debilitatum aliquandiu eſſe. Hoc ſtatum dum 16 horas permanſit fruſtra quæſitus, tandem repertum, conto in capite infixo, cujus etiam ſenſum ſe habuiſſe dixit, fundo extraxerunt, ſperantes ex more aut perſuaſione gentis revicturum eſſe. Itaque pannis linteiſque productum obvolvunt, ne aer admitte poſſit perniciofus futurus ſubito illapſu! Cuſtoditum ſic ſatis ab aëre ſenſim ſenſimque tepidiore loco admovent mox calidis adoriuntur faſciis, fricant, radunt, et ſufflaminatum tot horis ſanguinis corporiſque motum negotioſa illa opera reducunt: denique antapoplecticis et genialibus liquoribus vitæ reddunt et priſtinæ mobilitati. Retulit is atque oſtendit ſe etiamnum in capite circumferre veſtigia violentiæ a conto illatæ et cephalalgiis vexari graviſſimis. Et propter hunc ipſum caſum, religioſe a popularibus, et hujuſce rei teſtibus probatum, Sereniſſimæ Reginæ Matris munificentia et annuo ſtipendio eſt donatus."

 ſion

ſion in water the aſſociation betwixt the heart and lungs might perhaps be diſſolved, and an animal be inured to live commodiouſly under water for any time."

Let us move juſt a ſtep backwards in this new trade of making amphibious animals, and obſerve how the celebrated Buffon ſucceeded. "I procured a pregnant bitch (ſays Buffon) of the large greyhound kind; and when juſt about to litter, I fixed her ſo in a bucket full of warm water that her hinder parts were entirely covered. In this ſituation ſhe brought forth three puppies; which, after being diſengaged from their membranes, were immerſed in a fluid nearly of an equal temperature with that of the amnios. After aſſiſting the mother, and waſhing the puppies in this water, I ſuddenly removed them into a pale of warm milk, without allowing them time to reſpire. I put them into the milk in preference to the water, that they might have an opportunity of taking ſome food, if they found a deſire for it. I kept them immerſed in the milk for more than half an hour; and when taken out of it, all the three were alive. They began to breathe, and they diſcharged a quantity of fluid matter by the mouth. I allowed them to reſpire about half an hour, and again immerſed them in the warm milk, where they remained another half hour. I then took them out; two of them were ſtill vigorous, but the third ſeemed to languiſh: I therefore ordered it to be carried to the mother; which, beſides the three brought forth in the water, had littered other ſix in the natural manner. The puppy which was born in the water and had continued one half hour in warm milk before it was allowed to breathe, and another half hour after it had reſpired, ſeemed to be very little incommoded; for it ſoon recovered, and was as active and lively as thoſe which had received no injury. Of the ſix that were brought forth in the air, I threw away four; ſo that there remained only two with the mother, beſide the one that had been littered in the water. I continued my experiments upon the other two which had been twice immerſed in the milk. After allowing them to breathe about half an hour, I plunged them

them a third time into the milk, where they remained another half hour. Whether they ſwallowed any of the milk, I could not determine; but when removed, they appeared to be nearly as vigorous as before their immerſion." "I puſhed theſe trials no farther: but I learned enough to convince me, that reſpiration is not ſo indiſpenſably neceſſary to the exiſtence of a new born animal as to an adult; and that by employing certain precautions, it is, perhaps, poſſible to keep the foramen ovale open: and, by this means, produce excellent divers, or a ſpecies of amphibious animals, which would be able to live equally in air or in water."

I am ſorry to ſay that I cannot pay Mr. Buffon the compliment of thinking that he was deceived in ſo ſimple an affair as this; yet he certainly could not ſucceed. I leave it with my reader to judge what ſhall be ſaid of Mr. Buffon; for it was not the foramen ovale that he was to keep open, if he wanted to make Amphibiæ; but, ſince the function of the placenta was juſt cut off in theſe whelps, and ſince he did not allow them the office of the lungs, he was to ſeek for ſome other third function, which could ſtand in place of the functions of the placenta and lungs; and ſince no ſuch function has yet been obſerved, I judge from all the principles which I have laid down, that Mr. Buffon was telling a vain-glorious idle tale; that he was conſcious that he had ſucceeded in no degree: and that he could no more have converted them into amphibious animals, than he could have made them what they were, viz. plain whelps. "Sed quis fallat omniſciam, ut ſic loquar, naturam? Illa non colludit noſtris erroribus, et quod ignorantia celaverat ſuo detegit tempore."

CHAP. V.

OF MALCONFORMATIONS OF THE HEART, AND OTHER CAUSES, PREVENTING THE DUE OXYDATION OF THE BLOOD.

WE are at no period of life, from the cradle to the grave, exempted from thofe difeafes which prevent the due oxydation of the blood. They often are born with us; they often overtake us when advanced in life; they caufe an anxiety and mifery, which exceeds all other diftrefs: pain and fuffering of every other kind humanity can bear, but the feeling of inftant diffolution is what the nobleft mind finks under. We know by the pale and fubfiding countenance how awful the inward feelings are, and woe be to him who has not feeling enough to fympathife with this diftrefs, and an anxious defire to underftand the caufe, and to alleviate the mifery of inward difeafes which he cannot cure.!

Thefe are feducing motives, and might of themfelves have drawn me on to give this flight fketch of the malconformations and difeafes of the heart: but I feel alfo the ftronger motives of duty and neceffity; for truly, without fome knowledge of the ill organized, irregular, and difeafed heart, the ftructure and functions of the heart in its founder ftate would be but poorly underftood. This fketch, then, is the laft part of this anatomy of the heart.

While the following hiftory ferves to correct our notions of the mechanifm of the heart, we muft alfo obferve how it explains and illuftrates up to a much higher point the combined functions of the heart and lungs, viz. the oxydation of the blood. Perhaps no hing can better explain the effects of a full and healthy oxydation, than a fparing oxydation of the blood, fuch as produces difeafe.

The fœtus alone can live with its fingle heart; it lives in the womb by its having a heart different from that of an adult. A fœtus, then, being born, cannot live with that

that heart which ſerved it in the womb; and Nature, as I have explained already, divides the ſingle heart, and there is then a heart for the lungs and a heart for the body. But if any fault in the organization prevent this ſeparation of the heart; if the foràmen ovale be preſerved open; or if there ſhould be any hole in the ſeptum betwixt the ventricles of the heart; if the pulmonic artery do not admit the blood, now that the child is born, and ſhould breathe the air; if the aorta ariſe from the right ventricle, ſo as to carry off all the blood from the lungs; or if the aorta be ſo diſplaced, that its mouth ſtands in part over both ventricles, ſo as to receive the blood of both—then the organization, movements, functions of the heart, are all wrong; no blood paſſes into the lungs, the child cannot live; it either dies immediately in convulſive ſtruggles, or lives in miſery but a few years.

It is not in this rapid enumeration that theſe varieties of malconformation can be underſtood, nor yet do they deſerve to be minutely detailed. I ſhall keep the middle path; and thoſe of my readers will eaſily follow me who have ſtudied the mechaniſm of the heart; concerning which this ſubject will recal to their memory all the important facts.

The moſt uſual of all theſe diſorders of the heart is ſome fault in the pulmonic artery; and that diſorder again is fruitful of others: for if the pulmonic artery cannot receive its blood, the foramen ovale cannot cloſe: then the blood cannot circulate nor paſs into the lungs when they firſt expand; then the office of the right heart is taken away, it has no power but to drive the blood with ſtruggles through the foramen ovale into the left heart; the left heart then drives this blood, unoxydated as it is, into the aorta: the heart is now a ſingle heart; it is the left heart alone that receives or circulates the blood: either it labours but for a few pulſes, and then the child, after a convulſive ſtruggle, expires; or there is ſome degree of opening in the pulmonic artery, a little blood paſſes through it into the lungs; the child is

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by that enabled to ſtruggle with its convulſive pangs for eight or ten days, and then expires.

Such a ſcene the celebrated Dr. Hunter once witneſſed; and there was, I perceive, in that heart a peculiarity very much to be admired. The chief fault was in the pulmonic artery, which was contracted into a ſolid ſubſtance or cord abſolutely and completely impervious; ſo that the lungs had never received one drop of blood by the pulmonic artery. And here I muſt ſtop to notice one thing which I have always ſuſpected, and which this diſſection proves, viz. that though it is natural to believe, and the beſt phyſiologiſts ſuppoſe it, that ſome blood, as much at leaſt as to ſupport the form of the pulmonic veſſels, paſſes through the fœtal lungs; yet here is direct proof that a well-nouriſhed child may be born capable of breathing, and in which the pulmonic veſſels are all free except at the heart, in which not one drop of blood ever has paſſed into the lungs. But chiefly it is to be obſerved, that this child, with its pulmonic artery, quite impervious, could not have ſtruggled a ſingle day, far leſs ten days, without ſome proportion of oxydated blood! and accordingly we find that it had a ſmall portion, juſt ſuch as ſupported life for a few days; which ſmall proportion it obtained thus: The blood went to be oxydated, not from the right ventricle into the pulmonic artery, but from the left ventricle into the aorta; from thence into the ductus arterioſus; and then, by a retrograde courſe, backwards through the lungs; and then by the pulmonic veins it was returned oxydated into the left ſide of the heart, from whence it came. This child accordingly lived a few days, and could not live longer; becauſe this difficult circulation was continually accumulating a quantity of black blood in the right ſide of the heart.

This child, then, had a heart reſembling that of the Newt or Frog; for the pulmonic artery was cloſed, and the right heart of no value; the left heart puſhed its blood into the aorta, and the aorta, as we may expreſs it, ſent a ſide branch into the lungs. In this

firſt

first instance, then, of malconformation, the child could not live, because it wanted the pulmonary artery, and of course the office of the right ventricle; it had but a single heart.

Next to this disorder of the pulmonic artery, viz. being obliterated or being closed, is this: That the aorta, in place of arising distinctly either from the right or from the left ventricle, is so placed, that its root stands directly over the septum ventriculorum, or partition of the ventricles; that the partition is perforated with a large hole, opening a very free passage from side to side; and that the heart being cut up, we find, upon thrusting down the finger into the aorta, that it passes with equal ease into the right or into the left side of the heart.—All which we are the less surprised at, when we remember that in the Chick in ovo, the parts of the heart are all separate pieces, which are joined one to another; and that in the fœtus of other creatures, in the Frog for example, the auricle, ventricle, and artery, are first seen at a distance from each other and then joined *.

In this conformation of the heart, the single heart appears again in a new form, and the office of the right or pulmonic side of the heart is well nigh annihilated. First, The pulmonic artery is small, sometimes almost close: Secondly, The aorta, arising as well from the right as from the left ventricle, carries off one half of that blood which should be circulated through the lungs: And, lastly, That blood, small as it is in quantity, which has passed through the lungs, is brought round to the left side of the heart; but the left side is not as it should be, close, to keep this purer blood for the circulation of the body, but it is mixed with the blood of the right side, through the perforated septum,

* I do not mean to argue, that when we first see them, they are so little connected, that one could be awkardly joined to the other, nor that they have no real connection, because it appears as if they had not; but merely this, that as they seem, like the parts of the eye, to be organized in separate pieces, I should sooner expect an unnatural displacement of the vessels of the heart than in the middle of the femoral artery.

tum, ſo that its virtues, as oxydated blood, are diluted or almoſt loſt.

If the pulmonic artery were unaffected, and the aorta placed equally over both ventricles, then the one half exactly of that blood which ſhould be oxydated would undergo the change. But in all theſe malconformations, the root of the pulmonic artery alſo is in fault; it is narrow; it is ſo ſmall, that at firſt opening ſuch a body it alone attracts the eye; its mouth is ſometimes ſo beſet with a ſort of fleſhy granulous papillæ, that there is hardly left opening enough to paſs a ſilver probe. The degree of contraction in the pulmonic artery is the true meaſure of all the oxydated blood which that ſyſtem can receive; but in ſuch a ſyſtem the quantity is ſtill farther reduced by various accidents of the organization. Thus, for example,—The pulmonic artery, is, we ſhall ſuppoſe, but one-third of its natural ſize, and the original quantity of oxydated blood is proportionably ſmall;—next, the foramen ovale, being open, carries off much blood towards the left auricle; the aorta, planted over the right ventricle, carries off alſo much blood.—But let us ſuppoſe, that ſtill as much remains as to fill the pulmonic artery to its full; when the pure blood comes round to the left ſide, it is mixed through the foramen ovale, and through the breach of the ſeptum, with a quantity of black blood, which is continually accumulating upon it; and the ſmall quantity of oxydated blood is, if I may uſe the expreſſion, drowned in the general maſs.

That I may explain the point of its accumulating a little farther, let me repeat, that even in a child which has died on the tenth day of ſuch a diſorder, the heart is crammed with dark-coloured blood: That in thoſe children which have lived two or three years under ſuch a diſtreſs, the heart has been greatly enlarged: That in a boy diſſected by Sandifort, who died at fifteen, the thing that was firſt ſeen upon opening the body was, not the lungs covering the heart and lapping over it, but a large maſs, lying betwixt the lungs, oppreſſing them, and puſhing

pushing them aside in every direction. This was the pericardium covering a heart of enormous size, filling the thorax, and reaching almost to the first rib; very little of the right lobe of the lungs, and none almost of the left, was to be seen; the veins in the upper part of the thorax, viz. the subclavian and jugulars, were choaked by the pressure, and much distended; the heart itself was full of blood, and the coronary veins so turgid, that it resembled a most minute and beautiful injection of the heart.

But it is most of all singular, that this heart was so enlarged, that the great veins, (which are indeed as reservoirs for the right side of the heart), and especially the upper cava, dilated along with it in such a degree, that there was felt distinctly a pulsation in the neck by a sort of back stroke every time the heart beat.

Still a child, even with a heart so ill organized, may struggle through all the weakness and all the diseases of childhood * for a few years, but they are years of complete misery; and still, as is proved by much sad experience, the boy cannot live, but must die.

Another conformation, the strangest of all, is that in which new parts are added to the circulating system, as if with design to make it resemble the heart of an amphibious creature; for it happens sometimes, that there is as it were a third heart interposed. For example, the two vena cavas end in the right auricle, the pulmonic veins enter into the left auricle and the right and left ventricles receive their blood from their auricles in the usual way; yet the right ventricle sends out no pulmonary artery, the left ventricle sends out no aorta; but both of them pour their blood into a middle ventricle, and the arteries go out from it: and here, as the blood is fairly delivered by both ventricles into this third ventricle, and as the pulmonic artery and aorta both arise from it, there is, of course, a fair division of the blood; and of the quantity which should be oxydated, exactly

* Sandifort attended a puer cœruleus, who, in addition to his chief disease, passed through the small-pox and measles safely, and attained the age of fifteen.

one-half

one-half undergoes that change. This is somewhat like the heart of the Turtle; it is plainly the structure of an amphibious heart, a single heart; for though there be three cavities, yet are they single in their function; it is a single heart with half oxydated blood. Such a heart is sufficient for Amphibiæ, or for the fœtus, but not for a child, which must breathe and have a double heart.

These are a few of the varieties of the imperfect heart; but the sufferings of children who are born with these imperfections, the marks of imperfect oxydation, and the manner of their life and death, was a chief motive for entering on this subject.

When the heart is so imperfect that the child lives but a few days, its sufferings are slight, and not lingering, so that we cannot mark them: They are not explained to us by any account of its inward feelings: They are all accumulated into one terrible struggle, in which we see the worst marks of ill oxydated blood.

The child is born well and healthy, it cries and draws its breath, it is removed from the mother; the function of the placenta ceases, but there is no other to succeed it; the child turns black in the face, struggles for breath, and is convulsed; and without any apparent cause it seems in the agonies of death: But yet it lives, it becomes black all over the body; the blackness never goes off except when it changes sometimes into a deadly ash colour. The child continues for a few days labouring under almost unceasing convulsions, which growing gradually weaker, it at last expires; and while it lives, the heart palpitates, sometimes it throbs so, that it can be distinguished at a distance by the eye. Dr. Hunter, in the child which I have already mentioned, laid his hand upon the breast, and the throbbing which he felt there was terrible to him.

When the child has the heart so formed as to admit into the lungs even a very small proportion of blood, it struggles through the first years of life, and its protracted sufferings can be more easily observed. Then no mark of ill-oxydated blood is wanting; every thing is the

reverse

reverſe of health, or the natural appearance fluſhed and florid of a growing child; its colour is always dark, its motions languid and powerleſs; it is cold, ſo that the parents muſt keep it carefully wrapped in flannels and furs to preſerve any thing of vital heat; its breathing is difficult and diſtreſſed; fits come upon it at times; and if the child has begun to walk, the leaſt hurry, or fear, or quick ſtep, even walking acroſs the room, brings a return of the fit: in which the extremities are deadly cold, the face black, the breathing one continued ſtruggle, and the end of the fit is the obtaining of a degree of relief, which happens in a moſt ſingular way.

The coldneſs, the livor, the languor, the fainting, the ſtruggles for free breathing, are all marks of ill oxydated blood. The convulſive paroxyſm is a ſure conſequence of the want of ſtimulus and force, and of blood accumulating at the right ſide of the heart. If, then, the child fall down in this paroxyſm, it is the very ſureſt proof that ordinary reſpiration will not ſave him from the ſtruggle; if during the fit he breathe ſo that he recovers, and that preſently his ſtrength, colour, ſpirits, every thing, is in a degree reſtored; then is it plain that the reſpiration during the fit, imperfect as it appears to us, is really more effectual than ordinary reſpiration.

When we obſerve which is the moſt natural way of obtaining relief, and notice the very peculiar manner in which theſe children breathe, we ſhall underſtand why they are breathing beſt when we believe they are hardly getting breath, and how they are recovering ſlowly when we think them labouring in the greateſt danger. The child feeling the growing oppreſſion at its breaſt, if it be young, ſignifies a deſire to be turned upon its face; if not indulged, it contrives to turn itſelf that way before its hard ſtruggle begins. When the child begins to breathe hard, it drives out the air with a ſudden exertion, and apparent pain; he remains longer without reſpiration than an adult could do; his expirations are attended with a ſort of ſcream. What can this way of breathing mean? To my apprehenſion it implies that

kind of breathing which I have called forced refpiration, and no other plainly can ferve.

The ordinary refpiration, by which we draw in 40 cubic ounces of air, has failed; the fit is approaching, becaufe that quantity of air will not fuffice. However rapidly the child breathes, however rapidly the heart palpitates, it will not do, becaufe there are but 40 ounces of pure air mixed with the whole of that great mafs which remains always in the lungs. Then the child, driven by inftinct, provides for the fulleft refpiration: it turns upon its face, that the weight may help to comprefs the thorax; it forces with all its power, and feems to ceafe from breathing, and refrains a long while in that ftate, becaufe it is emptying and compreffing the lungs. Then its purpofe is accomplifhed; the lungs are more emptied than in ordinary refpiration; it draws in the largeft draught of air, utters a fort of fcream, feems quiet again; and again, by preffing its breaft, and by contortions (convulfive like of its body), it empties its lungs at a diftant interval, and receives again the fulleft draught of air. It is this forced refpiration that brings into the lungs 70 cubic inches of air more than the ufual refpiration does. This, then, is three times more effectual than ordinary breathing; and when a boy grown up to thofe years in which he knows the warnings of his diforder, and has found out this relief; when fuch a boy by preffing upon the corner of a table, or by throwing himfelf upon the ground, prevents or alleviates his paroxyfms, in what way can it be but by practifing for a time this deeper refpiration? preffing the cheft, forcing and compreffing the lungs beyond their ufual degree of collapfe, and fo obtaining a fuller draught, a draught of 110 ounces of air, to be mixed with the 110 ounces which muft always remain in the lungs?

After half an hour of a kind of breathing, moft awful to behold, but much more effectual than common breathing, the child recovers flowly. The boy, when advanced a few years, knows how to prevent the fit; but the child of two or three years old knows only how

to

to ſtruggle with it: yet this ſtruggle being a more effectual breathing, the child is relieved at once from an anxiety, and oppreſſion, and throbbing, which precedes the fit for many days; the languor goes off, the heat in ſome degree returns, and the lips acquire a vermilion colour and the ſkin a higher tint, which laſt for many hours after the fit is gone.

In thoſe children, again, which have the heart ſo formed that they may live not two or three years only, but to the age of 15 years, it naturally happens that the ſymptoms follow each other in their courſe very ſlowly; and the ill oxydation of the blood in this its ſlower progreſs it is very curious to obſerve.

There is one thing in the economy of the fœtus very ſingular, viz. that while it is receiving much oxydated blood from the mother, but a ſmall portion goes through the ductus venoſus directly to the heart, much of it circulates through the liver, and is ſpoiled (we muſt ſuppoſe). What then can this mean? Surely the child, the chick, the fœtus of every kind, needs leſs of this principle of oxygene: the fœtus lives (if this be ſo) like an amphibious creature; perhaps it has little oxydated blood; yet being totally deprived of that little, it ſoon dies. Perhaps the fœtus, living the life of an amphibious creature, does not want alſo that peculiar tenacity of life which characteriſes that claſs; for the ſtruggles and ſufferings which a weakly infant endures, before it parts with life, are matter of obſervation even among the vulgar. For this reaſon I believe it is that children, having a heart ſo ill arranged that abſolutely they cannot live beyond the years of puberty, yet during the firſt year feel no complaint, and ſeem thriving and healthy; the vegetating life of a ſucking child ſaves it from all dangers of hurried reſpiration and rapid pulſe.—But when it leaves the breaſt; when it begins to ſtir and move; when its blood, moving languidly, begins ſlowly to accumulate at its heart; when the properties of its living fibres change, ſo as to require a fuller ſupply of oxygene from the blood—then the ill colour, languor, palpitations, ſlighter fits, and all the marks of its

diſeaſe,

disease, begin; and often its colour gradually changes, and it becomes the puer cœruleus, or livid child, before we can perceive by any other marks how dangerous a condition it is in.

In one child * the first year had elapsed before the very slightest of those complaints came on, which ended in death at a very distant period of 15 years. At first its finger nails were observed to be livid, yet not continually; the colour varied, but still the nails were unnaturally livid, so as to alarm and surprise the parents; but there was as yet no reason to desire advice. The child seemed healthy, began to use its legs, and in the second year it walked alone.—Next it happened, that one day after being forced to take a medicine, not without some resistance, his face was on the following day freckled with red spots, which soon changed to a livid hue. Now the lassitude and chillness came on; motion or exercise were more and more oppressive to the boy; till at last when he fatigued or hurried himself, the hands and feet became livid, the mouth and tongue became almost black, and last of all those fits came on in which the whole body becomes livid or black.

This is the progress of this darker colour of the body; but his other complaints also advanced with a very slow and regular pace. He increased in stature, his appetite was good, he complained of great lassitude, of head-ach, with a sort of gravitating pain, of anxieties, especially during the winter months, and of such extreme coldness, that neither fire in winter nor summer's sun could warm him; he never felt heat except when just wrapped up and newly laid in bed.

Now the blood began to accumulate; the struggles of the heart began; and so terrible were the throbbings of his heart at times, that they might be seen or even heard. Actual faintings succeeded; the poor boy, now eleven years of age, knew that he was to die; he said, that "no one could know or cure his illness, and that no one could imagine what feelings he had here at his heart."

* Vide Sandifort.

Motion

Motion was now quite impoffible; upon the flighteft effort faliva flowed from his mouth, a fainting fit enfued, and he continued for a little while blind. All that he was wont to delight in was now indifferent to him; he could not move; his face was turgid, his eyes prominent, his feet were fwelled with an œdema, his eyes dead and heavy, expreffive of fome inward diftrefs; when he was put to bed his anxieties were very great, and thus he died a flow and miferable death.

Sometimes a child wants fpirit or ftrength to ftrive againft the laffitude of this difeafe. A girl under Vafalva's care lived to her fifteenth year; but from her infancy, from her very birth, fhe had lain in bed, partly on account of ficknefs, but chiefly on account of extreme weaknefs. She had a fhort and difficult breathing, and her fkin was tinged all over with a livid colour; her quiet ftate faved her from the fuffocating paroxyfms; but her heart was juft like all the others, the foramen ovale open, and the pulmonic artery clofed.

Thefe, then, are the marks of ill-oxydated blood: a livid colour, coldnefs which nothing can remove, oppreffion and anxiety of the breaft, palpitations and difficult breathing; and when the blood is by paffion or motion hurried too faft towards the right fide of the heart, then come fits, which laft a longer or fhorter time in proportion as they have been long delayed, and which end in death. And laft of all, I would rank among thefe confequences an imperfect nourifhment, for all the boys have been fmall, moft of them particularly flender; and one boy efpecially, of fifteen years of age, is mentioned by Hunter, who, in refpect of tallnefs, was juft what you fhould expect at his years, but flender to a wonderful degree; not as if wafted by confumption, but as if by natural habit. His form was quite furprifing, fo that Hunter could give no idea of his fhape, otherwife than by comparing his body with that of a Greyhound; and his legs, he fays, put him in mind of thofe of a Crane, or fome tall water-fowl.

The confequences muft be alike, whether it be that the heart fends no blood towards the lungs, or that the lungs

lungs cannot receive that blood; and the malconformations of the heart are hardly more frequent than thoſe of the lungs; and both, we may be well aſſured, are infinitely more frequent than we ſuppoſe; eſpecially when we obſerve how many children die ſuddenly, diſcoloured, and in convulſions; and how many of thoſe advanced in years have lived very miſerable with complaints in the breaſt.

A young man of twenty-four years of age, by birth a Pole, and at the time of his death a ſoldier in the German ſervice, had been continually oppreſſed from his cradle upwards with difficult breathing and anxieties at his breaſt. He had been three or four times relieved from ſlighter complaints of the breaſt; but at laſt the bleedings and demulcent medicines failed: he lay ill in the military hoſpital two months, where of courſe his complaints were correctly known. He had none but the ſlighter degrees of difficult breathing; when one day ſitting up in bed he ſuddenly expired. Being opened, the right ſide of the lungs was found to be totally wanting; not deſtroyed by diſeaſe, as we have often ſeen, not oppreſſed by water nor eroded by pus, but entirely wanting; a peculiarity which he had from his mother's womb, for it was attended with a peculiar arrangement of the veſſels. On the right ſide there was no veſtige of the lungs, not even the ſmalleſt button to mark where they might have been; there was no branch of the trachea for the right lobe intended by Nature, but both the legs of the trachea plunged into the left lung, which was large: There was no forking of the pulmonary artery to give a branch to the right ſide, but the whole trunk of the pulmonic artery plunged into the left lung.

But if one ſhould ſuſpect that there might have been once a right branch, the lungs deſtroyed, and the mouths curiouſly united by that mucus which the membranes of the viſcera, and the pleura eſpecially, throw out when inflamed; there are ſtill other caſes which muſt remove all our doubts, eſpecially that of a young man *, who

* Under the care of Dr. Heberden. Vid. *Acta Vendobonenſis.*

died

died in a very lingering way, and in whom before his death there was plainly perceived, along with his ſlight anxieties, a pulſation in the right ſide of the breaſt. Upon opening his body, there was found in the left ſide neither lungs nor heart; nor, upon the moſt careful examination (ſeeking for the waſted lung), could there be found the ſmalleſt remains of lungs, bronchiæ, pulmonic arteries, or the ſlighteſt evidence that any ſuch parts had ever been. But the ſureſt proof of this remains behind, for the heart ſtood in the right ſide of the cheſt; it ſtood perpendicularly, quite upright like a Dog's; it gave out a right pulmonic artery, but there was not even the ſmalleſt veſtige of any artery having been appointed for the left lobe. We muſt not ſay, yet his cheſt may have been full enough of lungs and heart, and he may have had a well-oxydated blood; in which caſe it was no very dangerous derangement that his lungs were all on the right ſide, more than if his liver had been on the left. But let us notice that the aorta was extremely ſmall; the diameter of the aorta is the true meaſure of the blood which is received from the lungs. Where the aorta is ſmall, ſurely the lungs are not good, nor the ſyſtem fully ſupplied with oxydated blood.

We alſo know that though the veſſels of the lungs themſelves may be natural and well arranged, the lungs may ſtill be amiſs; they may want the proper ſtructure of cells in which the blood ſhould be expoſed; they may be encumbered with tumours ariſing out of their ſubſtance, by which they will be prevented from dilating. One is pleaſed to find in old authors good deſcriptions of diſeaſes which have remained for ages unknown; and among theſe I reckon that of the celebrated Spindler; whoſe deſcription I admire as much as that of any ſucceeding author.

The child of a certain prince having died after a few days of great ſuffering, Spindler opened the body, and found all ſound and right, except that there were ſeated upon the two lungs two tubercles of a variegated red colour, as were the lungs themſelves; which tumours, no doubt, hindered the paſſage of the blood, which he

expreſſes with a correctneſs in reſpect of phyſiology quite unknown in thoſe times. " Quæ vomicæ procul dubio hujus aſphyxiæ cauſæ extitere denegata circulatione ex dextro in ſiniſtrum cordis ventriculum." His deſcription of the diſeaſe ſo long before it was properly underſtood is curious: " During the eight days in which the child lived, it had never cried ſtrongly nor clearly, had never ſucked, had never been regular in its bowels, breathed as if its ſides had been blown up; it was ſuddenly ſeized with a fit, which ſeemed epileptic, ſoon went off, but ſoon returned; the whole face and body became firſt red, then of a copper colour; the breathing was interrupted, the eyes immoveable, the feet and hands lay almoſt lifeleſs; it ſuffered at leaſt a hundred of theſe fits before it expired."

To enumerate thoſe caſes where a defect of the lungs were the conſequence, not of malconformation, but of diſeaſe, were a buſineſs quite inconſiſtent with my deſign; yet I wiſh to record theſe two.—Firſt, It has been long obſerved, that by long continued ſuppuration, the lungs are often ſo waſted that not a bud or particle of them remains: ſometimes theſe patients ſurvive, dragging on a languid and miſerable exiſtence, enjoying no freedom, life, nor ſpirits; and the cauſe of their frequent ailments is diſcovered at their death. The lungs alſo may be thus compreſſed even by the mere preſſure of water within the cheſt, which has cauſed ſuch a ſubſiding, or rather abſorption, of the lungs, without any ulcer of their ſurface, that one lung has been oppreſſed till it became no more than three lines in thickneſs; and indeed it was not eaſily found: ſo Haller ſays in his Commentary upon Boerhaave. But of all the ſtrange things which Haller or any man has ever related, what he tells in the following words is the moſt incredible; at leaſt it is ſo improbable as to be incredible: " A man having died of a lingering diſeaſe occaſioned by a fall, the left lobe of the lungs was not to be found; that ſide of the cheſt was full of a coagulable ſerum; but the aſperia arteria and large arteries and veins (a thing which I never could have believed, had I not ſeen

it

it myſelf) opened with gaping orifices into the cavity of the thorax, as if they had been cut acroſs; ſo that it was very hard to conceive what had prevented the blood from pouring out." Haller, p. 34.

Secondly, In the peripneumonia notha there is not merely an inflammation of the pleura, as the name expreſſes, but of the lungs themſelves; and it is not from inflammation, pain, fever, or acute ſuffering, that they die; but becauſe the lungs are entirely crammed with blood; the heart can no longer move: they are not ſenſible of their dangerous ſtate, but are ſuffocated in a moment, and die without a groan. It ſeems more frequent in other countries than in this, though no country is exempted. When this diſeaſe comes upon a place, it comes with all the frequency and deſtruction of an epidemic diſeaſe; and the ſudden unexpected deaths are terrible. Vaſalva found an old gentleman going abroad in the morning, and prevented him, queſtioning him about his complaints, which he himſelf thought very ſlight: but Vaſalva gave notice privately to the ſervants to expect nothing better than their maſter's death; and notwithſtanding all aſſiſtance, he was that very evening dead.

The pulſe is weak, the cough ſlight, the difficulty of breathing more anxious than painful; the face ſunk in the features and fluſhed, or rather of a lurid colour, except when it is cadaverous, pale, and ſallow; the ſuffocation is ſudden; the lungs have, as Morgagni expreſſes it, a liver-like, ſolid conſiſtence; they have no longer the cellular appearance of lungs, for their bronchiæ are crammed with blood; their common cellular texture is alſo full of exuded blood; they are denſe, ſolid, very heavy, and black, and they ſink in water like the lungs of a fœtus. The heart is ſo curbed in its actions, that it gives but a ſmall, feeble, and trembling pulſe; and even in a few days (as in the fœtus having an imperfect organization) the heart is wonderfully dilated and enlarged, and filled with fluid and grumous blood. Haller laments the death of friends by this terrible diſeaſe, and eſpecially of his own ſon,

 "whoſe

"whofe body he gave to be opened by thofe fkilled in diffections."

Perhaps the heart may be too fmall for the fyftem to which it belongs; and this, I doubt not, had been the cafe with that boy in whom Kerkringius found it fo fmall, that though the boy was nine years old, the heart (*i. e.* the ventricles) was no bigger than that of a fœtus; and the whole heart, auricles, ventricles, and all, was no bigger than that of a child born at the full time. But in proportion as the heart was fmall the veffels were large, not at all aneurifmal, but of fuch a fize, and fcarcely of fuch a fize, as might fuit the heart of a boy of nine years old. This boy had for five years been hectic, that is to fay, he had been troubled with no formed difeafe, but with continual diftrefs, anxiety, weaknefs, and quick pulfe. This heart was plainly inadequate to the functions of any fyftem; but the cafe is too flightly fketched for us to find any decided marks of ill oxydated blood.

But that the heart may be too big for its fyftem, is a melancholy fact; for when it becomes relaxed, it enlarges, and as it grows in bulk lofes in power. That the heart is enlarged merely by weaknefs, by fubmitting to dilatation, by wanting fufficient power to free itfelf of accumulating blood, is very plain; for in the plague, in low and peftilential fevers, even in nervous affections, it fometimes enlarges, and this enlargement from a temporary becomes a mechanical and fixed difeafe. How often do we read in the preface to fuch diffections of enlarged heart, "he was of a melancholy temperament, of a flow and fedentary life, oppreffed by misfortunes, and ftruggling with vexations and grief." In the angina pectoris, which is in its firft attack no organic difeafe, we often find the dilated heart pale and tender, fo that the fingers may be pufhed through its flefh.

While the heart gradually enlarges, the fyftem changes, and accommodates itfelf to its powers. There is little diftrefs; often we find a heart enlarged to a degree fuch as we never could have fufpected before death. But flowly there is formed fuch an accumulation of ill-oxy-

dated

dated blood as oppreſſes the vital powers, and chokes the motions of the heart, and draws after it thoſe other diſorders which are already in part explained.

Of the mechanical conſequences which follow the enlarged heart, thoſe chiefly attract our attention which prevent the due oxydation of the blood.

Firſt, the dilatation of the heart draws after it a dilatation of the great veins, ſo that they become reſervoirs as it were; and the auricle and veins both enlarge ſo, that the office of the auricular valves is quite loſt; the veins feel, or rather the column of blood in the veins feels the back ſtroke from the heart, and it is perceived even in the neck by a ſtrong pulſation.—Secondly, Theſe veins, and this monſtrous heart, ſo fill the cheſt, prevent the blood of the neck deſcending, and ſo puſh aſide the lungs, as to compreſs them to the laſt degree that is conſiſtent with life.—Thirdly, The enlarged heart accumulates much blood in the ſyſtem which before did not exiſt, and that blood dark coloured and unfit for the purpoſes of life. The proportion betwixt the great maſs of ill oxydated blood lingering in the veins and about the heart, is increaſed ſo very greatly, in oppoſition to the very ſmall quantity which can now be oxydated in the lungs, that ſuch perſons are expoſed every moment to the greateſt dangers; and the leaſt accident which draws out more black blood from the veins, and hurries it towards the heart, quite overcomes them. Then there is an agonizing and fearful ſtruggle; the heart often ſtruggles, and often frees itſelf; but in moſt caſes thoſe who live in this condition do, after many eſcapes, fall down ſuddenly dead. " A very learned man having this enlargement of the heart while he was ſtill walking about in his ordinary health, his heart would often ſtop for three or four pulſations, as if ſtruggling with its load, velutque expulſionem moliretur *."—Fourthly, In this enlargement of the heart, although ſometimes there is a perfect and equal pulſe, though ſometimes alſo the diſeaſe ſcarcely ſhows itſelf

* Veſalii, lib. i. cap. v.

till very far advanced, and after many years of ſlow increaſe; yet the heart being continually loaded, and often ſtruggling, cannot free itſelf at one ſtroke of all its blood; then, ſtroke ſucceeding ſtroke in a confuſed irregular way, there is a weak, irregular, intermitting, fluttering pulſe.—Fifthly, But Nature, wonderful in her ways, ſometimes finds relief from this in the regular conſtitution of theſe parts; for while the heart dilates, and becomes more powerleſs as it dilates, the aorta (being but poorly filled) contracts in proportion as the heart dilates, and accommodates itſelf to the ſmall quantity of blood which ſuch a heart can give out; and thence the wonder ſometimes expreſſed at finding an aorta extremely ſlender joined often to an enormous heart.

"In opening the body of a ſhoemaker, ſays Morgagni, whoſe heart was wonderfully enlarged, ſeeming as if you had joined two hearts, what chiefly ſtruck us was the ſmallneſs of the aorta, more ſuitable to a delicate woman than to a man of good ſtature as this was. The aorta, from its paſſing under the diaphragm to its great diviſion in the pelvis, was very ſmall." This Morgagni firſt of all believed was owing to ſome ſtricture at the diaphragm; for the aorta did not paſs as uſual under the legs of the diaphragm, it paſſed through a peculiar hole; but he found this tendinous hole quite large and free. Still he believed that all the diſorder of the heart aroſe from the contraction of the aorta, and that again from the crooked poſture in which thoſe ſit who are of this trade. But that often the artery is contracted in favour of the enlarged ventricle, I am able to prove better than by this caſe of Morgagni's. In the firſt place, the diſtorted poſture of his ſhoemaker can have no effect; for we muſt not forget how limber, flexible, and free from diſeaſe, the aorta is in thoſe who have the unhappineſs to be deformed, and in whom the aorta follows the ſpine ſo cloſely, that often the bones almoſt meet in their diſtortions, and hide it. I have cut out theſe aortas ſometimes and laid them on boards, to ſhow the ſtrange angles which they make with ſuch perfect ſafety. Next I have to obſerve, that where the auricles and

ventricles

ventricles dilate in old people, the aorta alſo dilates: for there the aorta is old, partly oſſified; its muſcular coat ſtiff and incapable of action; it is, in ſhort, as weak as the heart itſelf, and yields along with it to the accumulating blood. But in younger men, the aorta being muſcular and ſtrongly contractile, this phenomenon enſues: that as the heart increaſes in ſize and weakneſs every day, it ſtruggles with leſs effect againſt the accumulation; its pulſes are imperfect; it delivers leſs blood into the aorta; the aorta, leſs perfectly filled, is not excited by the ſame power which formerly filled it and kept it full: therefore it contracts gradually and ſlowly; it preſerves ſtill its healthy conſtitution; it is limber, pliant, and ſound, in its muſcular coat. In ſhort, this doctrine of Morgagni's implies only a ſtationary condition of the aorta; this other theory implies an active contraction. Now Morgagni's ſhoemaker was a portly man, but his aorta was ſmaller than a woman's. Even this caſe of his own implies an actual contraction; ſince, had this man's aorta continued ſtationary, it muſt have been ſtill the aorta of a man of good ſtature, joined to a large heart. But a perfect proof is this: I have a heart which it would not be eaſy to deſcribe; it is not only as big as two hearts joined, but I may ſay, with Bartholine, "ut ſæpe in Bobus non magis ſit aut ponderoſior." The heart is bigger actually than an ox's; it is bigger, I think, by the whole ſize of its two great auricles; it is injected with wax; it weighs more than four pounds, and is two feet in circumference; but the aorta is no bigger than the femoral artery at the groin, very ſtraight and even in its diameter, very ſlender, and with coats which plainly have been very thin and ſuitable to ſuch an artery. Here the artery is equably and fairly contracted to one-fourth of its natural ſize, which ſuppoſes a natural and ſound condition of its coats: And one of two things muſt have happened, either the artery muſt have contracted firſt, oppoſing the heart and cauſing it to enlarge; but then its violent contraction, like the urethra contracting in oppoſition to the bladder, would have thickened it into a ſtrong muſcular tube:

or,

or, ſecondly, the artery muſt have contracted gently and gradually in favour of the dilatation and weakneſs of the heart; and then it would remain (as this artery really was) very ſoft, delicate, and limber. I ſuſpect alſo, that where the aorta is enlarged, there is required a ſtrong, ſmall, and muſcular heart; becauſe I have an aorta enlarged to a very great degree, the heart being extremely ſmall. Theſe accidents will be noticed chiefly where, in young people, there happens ſuch diſproportion of muſcular power betwixt the heart and its veſſels; but in the aged, all the parts are but too much diſpoſed to diſeaſe, and the whole will enlarge.

Theſe, then, are the chief conſequences of that enlargement of the heart which often ſo fills the thorax and loads the diaphragm, that it falls down under the weight of the heart: then the heart is felt lower than natural; and the diſorder is named by moſt authors the prolapſus cordis. In a young man of twenty years of age, the moſt miſerable creature I ever ſaw, I have felt a prodigious heart beating as if quite in the abdomen: at the pit of the ſtomach the pulſation was particularly ſtrong; it muſt have been miſtaken for an aneuriſm of the cœliac artery, had not the heart been felt beating from the navel almoſt to the collar-bone.

Whether we are to allow, that the blood ſometimes does coagulate and form polypi in thoſe enlarged hearts, I believe no man in the preſent ſtate of our knowledge will venture to decide. That the blood ſhould coagulate thus firmly, while within the body, and that not in a corner of the circulating ſyſtem, but in the heart itſelf, where always there muſt be ſome motion, it is not eaſy to believe; nor that ſuch coagulations ſhould remain there, be waſhed pure by the current of blood, ſo as to have a leathery colour, and to be firm and ſtrong; that ſuch coagula ſhould entangle the valves and columnæ carneæ, ſhoot up into the great veſſels, and hinder the movements, and cloſe, in ſome degree, the openings of the heart, is quite unlikely: yet if there be uch a thing, this muſt ſtand as the deſcription of a ſolypus of the heart. I incline then rather to the opi-

nion of the able and diligent Kerkringius, who calls them pſeudo-polypi, baſtard polypi, mere clots of blood; of which he produces drawings from the pulmonic veins, the liver, the heart, the brain, &c. wherever great veins are.

That when the heart is monſtrouſly dilated, clots may be formed in it, very large, filling all its cavity, but ſtill happening chiefly in the moment of death, or during its ſlow approaches, I believe from what Veſalius relates; who, " in the heart of a nobleman, found two pounds of a dark coloured fleſh; upon which lump, the heart, of monſtrous ſize, was extended like a gravid uterus." But this black fleſh, ſince it was unconnected with the walls of the heart, was a mere clot; which, had it come really from the womb, Veſalius would have called a falſe pregnancy, an ovum deforme, or what the vulgar call a mole.

This, and all the leſſer polypi, thoſe ſtrings of coagulum which entangle the columnæ, and ſtretch upwards into the veſſels, are really formed in the moment of death. But it is not to be forgotten, that many of the moſt eminent men have thought quite the reverſe of all this. Polypi, when firſt noticed, ſeemed a ſtrange and awful and frequent cauſe of death. Having once believed and wondered at ſuch a thing, people did not even like to be diſabuſed; and when Kerkringius called them pſeudo-pôlypi, the whole phyſicians, like a hive of bees, ſwarmed out upon him at once. Tulpius, Malpighi, Pechlinus, ridiculed this opinion. Pechlinus was ſo offended, that he could not refrain himſelf from low and mean language. " True polypi there certainly are, ſays he, but theſe polypi of Kerkringius are indeed pſeudo-polypi, and every blind ſhaver knows them abundantly well;" (tam eſt vulgaris et lippis tonſoribus notus). " The ſhop-boys, ſays Pechlinus, make ſuch polypi, by pouring vitriolic acid into the veins." Yet with all his bitterneſs, Pechlinus has not proved, to my ſatisfaction, either by his arguments, or by his caſes, that polypi exiſt; but he made many believe him, for the ignorance of that time is very ſingular. Dr. Petrus Ruſſe

Ruſſe tells us, that he had once found a polypus in the longitudinal ſinus of the dura mater, of a quarter of a yard long: "Let this be put down," ſays he, "as one proof at leaſt that polypi are ſometimes found higher than the noſe." What muſt have been the confuſion of their notions, who could thus jumble the ideas of a polypus of the blood-veſſels and a polypus of the noſe?

They even miſtook ſuch clots for living animals. Dr. Edward May ſent from England to the celebrated Severinus a deſcription of an Eel which he had found in the cavity of the heart. He entitles it, with ſome propriety, "Hiſtoria mirabilis anguis bifidi." It is, indeed, a wonderful ſtory; they deſcribe head and tail, and all fairly, as if it had been *bona fide* a living creature; and tell us how its head was ſticking to the inſide of the heart (where you may ſuppoſe it was biting), and how its body was very white and very ſtrong, and its arms or tails, I do not know what to call them, red. But what amuſes one moſt of all is the important air of theſe communications betwixt Severinus and Dr. May; and then Severinus, warning his pupils againſt incredulity, and telling them, "that though wounds of the heart are really mortal, yet ulcers of the heart certainly are not mortal;" by which he means, that while the Eel was alive it was continually biting the heart *. In ſhort, from theſe things, we perceive that we need not look into books for any ſatisfaction on this delicate point; that we muſt depend upon ourſelves, and make a better uſe of all future occaſions; for unhappily there are no good hiſtories attached to thoſe diſſections in which the coagula have been likeſt to thoſe of a long formed diſeaſe †.

The heart, which is ſo often dilated by weakneſs, is

* It is certain enough that ſmall worms are found not only in the œſophagus, but in the aorta too, of Dogs and other animals. Vid. Morgagni's *Adverſaria*. For plenty of real worms in the heart, producing St. Vitus's dance in boys and hyſterics in girls, vid. *Sckenkius*, page 272.

† A caſe liker this diſeaſe than almoſt any other, is a very melancholy and affecting ſtory of a Mr. Holder, an apothecary. Vid. *London Medical Journal* by Simmons, and *London Medical Communications*.

ſometimes

ſometimes reduced in ſize by an increaſe of ſtrength and action. It becomes denſe, firm, thick in ſubſtance, but ſmall in its cavity; it appears to be dilated without, but is, in fact, contracted within. This thickening of the walls of the ventricles is what I cannot underſtand, though I have cut many ſuch hearts with the utmoſt care. There is no oſſification of the valves, no ſtraitening of the aorta, nor any other obſtruction to excite the heart. There is no enlargement of the auricles, no dilatation of the veins, no diſeaſe of the arteries, nothing appears but a thickening, and enlargement, and condenſation of the walls of the ventricles, a proportionate enlargement of the columnæ carneæ, and a proportionate narrowing of the cavity of the heart itſelf. Upon opening ſuch a heart, one would almoſt pronounce it natural. If one ſhould ſpeculate upon its peculiarities, he would (finding the heart ſtrengthened, and its valves and veſſels all ſound) pronounce that it would cauſe rather a vigorous circulation and ſtrong health: yet I ſhall never forget the miſeries I have ſeen patients endure from having ſuch a heart. They have often a full and bloated habit of body (at leaſt ſo I have chanced to obſerve), a pulſe weak at all times, but trembling, and hardly ſenſible, when a fit of difficult circulation approaches; then the pulſe vaniſhes, the patient ſometimes faints; the anxieties, oppreſſed breathing, languid pulſe, actual faintings, and all the intermediate conditions leſs than fainting, but like it, and infinitely more miſerable, make their chief ſufferings. After ſtruggling long under this diſeaſe, the patients grow languid for a few days, often become dropſical, and then die.

The variety of ſymptoms which thoſe ſuffer who have this ſimpleſt of all the diſeaſes of the heart is very ſurpriſing, and puts to nought all our conjectures about certain ſigns indicating particular diſeaſes of the heart. We cannot be ſurprized that in great enlargements of the auricles, or vaſt aneuriſms of the aorta, or in thoſe enlargements in which ſomething like polypi are found, and where, as Mr. Holder often ſaid of himſelf, the circulation ſeems to go on for a time in one corner,

as

as it were, of the heart; in all ſuch caſes, we cannot wonder at there being heard noiſes like the ruſhing of water. But how ſuch ſhould be heard in this thickening of the heart, I cannot conceive: yet it is certain that one gentleman, whoſe diſeaſe came upon him all at once, and while perfectly at reſt, with the ſudden ſenſe of ſomething burſting within; who had moreover for ſeveral years a palpitation which could be felt outwardly, and a plunging noiſe, which at times the by-ſtanders could hear very loud; who died in the end in great diſtreſs,—had yet none of theſe oſſified valves, enlarged aorta, nor other organic affections, which there was ſo much reaſon to ſuppoſe, but merely this thickening of the ſubſtance of the heart.

Among the diſeaſes of the heart we may reckon the dilatation of the aorta, a diſeaſe more frequent than all the others, and more dreadful. It is a diſeaſe more frequent in the decline of life; it is then a diſeaſe of weakneſs; it ariſes from a cauſe quite different from that which is commonly laid down. The celebrated Dr. Hunter believes that it ariſes from that prediſpoſition or weakneſs which naturally belongs to the form of this part, viz. a ſudden angle of the artery, expoſed in the moſt direct manner to the whole force of the heart. Dr. Hunter alſo believed, that no ſooner is Nature ſenſible of this danger, than ſhe ſeeks to prop up the artery; and for this end thickens its walls till it oſſifies by ſlow degrees. Haller's theory is different from this, and comes nearer to the truth; for he makes theſe ſcales of oſſification not the conſequence, but the cauſe of the diſeaſe. He ſays, the artery becoming ſcaly, and partly oſſified, no longer yields to the force of the heart; and the heart thus excited to a higher action is itſelf dilated, and at laſt forces alſo the aorta. In truth neither of theſe is the true theory; but the aorta in aged perſons beginning to oſſify, has its middle or muſcular coat annihilated, and its outer and inner coats thickened, by the ſame proceſs. Its muſcular power is loſt; it is no longer capable of withſtanding, much leſs of ſeconding, the ſtroke of the heart by a ſecond ſtroke; it ceaſes to act,

act, ſuffers itſelf to be dilated, and in a few years grows into a dreadful diſeaſe. I never ſaw an old aorta without ſome ſpecks of oſſification, or rather of calcareous concretion, nor an aorta ſo affected which was not dilated in proportion pretty nearly to the degree of this thickening and oſſification; at which we need not wonder, ſince we find not a bone (as it is uſually called oſſified aorta), but a vile calcareous concretion ſubſtituted to its muſcular coat. Nature is not at this time, as Hunter ſuppoſed, building up and ſtrenthening the walls of the aorta againſt this diſeaſe; but taking down ſlowly that fabric which has laſted its appointed time.

However produced, it is an awful diſeaſe; for every organ, when once deranged, eſpecially if it be one as active as this is, never ſtops in its courſe; and this eſpecially ends early or late in ſome terrible kind of death. Sometimes, increaſing in ſize, it deſtroys all the ſurrounding parts and burſts within. Sometimes it burſts into the cheſt, and then the patient drops ſuddenly down; ſometimes into the trachea, and then the cauſe of the ſudden death is known; for the patient, after violent coughings and ejections of blood by the mouth, expires. Sometimes it beats its way through the ribs, deſtroys the vertebræ, affects the ſpinal marrow; and thus the patient dies a leſs violent or ſudden death. Moſt frequently, the tumour riſes towards the root of the neck, is felt beating there, deſtroys the ſternum, burſts up the ribs, diſlocates and throws aſide the clavicles, appears at laſt in the form of a great tumour upon the breaſt, beating awfully.—A dreadful ſtate! and with nothing to keep in the blood but a thin covering of livid ſkin, which grows continually thinner, till, burſting at laſt, the patient expires in one guſh of blood.

But Nature can ſeldom bear all this diſtreſs; the patient dies before this awful ſcene commences; for the aorta often ſo fills the cheſt, ſo oppreſſes the lungs, chokes the trachea, and curbs the courſe of the deſcending blood, that the ſyſtem, with a poor circulation of ill-oxydated blood, is quite exhauſted! And thus, though

though the patient is ſaved from the moſt terrible ſcene of all, he ſuffers great miſeries: he feels ſharp pains paſſing acroſs his cheſt, which he compares with the ſtabbing of knives and ſwords; terrible palpitations; often an awful ſenſe of ſinking within him; the ſound within his breaſt as if of ruſhing waters; a continual ſenſe of his condition; ſudden ſtartings during the night, and fearful dreams, and dangers of ſuffocation; until with ſleepleſs nights, and miſerable thoughts by day, and the gradual failing of an ill-ſupported ſyſtem, he grows weak, dropſical, and expires.

How, except by attributing them to ſome peculiar weakneſs, to ſome inward prediſpoſing cauſe, ſhall we account for all theſe terrible diſeaſes of the heart? Albertine aſcribed them ſo entirely to the paſſions of the mind, that he gives this as the chief reaſon why in the lower animals * ſuch accidents are not found. This is ſtrange philoſophy; for who does not know that the human paſſions are remarked only becauſe they ſhould be under continual reſtraint and controul; while thoſe of animals paſs thus unnoticed by Rammazini, only becauſe they are wild and furious, and we do not expect that they ſhould be reſtrained. The wild and ungovernable ſpirits of animals would produce ſuch diſeaſes ſurely, if ſuch cauſes could; but whether they do produce them, neither Rammazini nor any of us know; we are too careleſs of this kind of diſſection.

Often, as I have explained, theſe complaints lie dormant for years, till on ſome violent exertion the patient begins to feel them; and when queſtioned by his phyſicians, being himſelf alſo extremely anxious to recollect the cauſe, and always willing to ſatisfy his phyſician, he remembers ſome violent exertion, ſome paroxyſm of paſſion, ſome fit of coughing, or ſomething even leſs important than all this; and tells how from that day he does not think he has enjoyed an hour of health.

That theſe diſorders will ariſe from too violent exer-

* Had Rammazini never ſeen a Dog enraged, nor a wild Bull, nor untamed Horſe, nor a Cat with its back up?

tions,

tions, independent of all predifpofition, we have every reafon to believe. Sometimes from blows, more frequently from fhocks or falls (for I have formerly noticed how little there is, except its veffels, to fupport the heart, or hang it within the cheft); but moft frequently of all have we reafon to fufpect thofe kind of exertions which are accompanied with a rapid pulfe and hurried refpiration. Of this kind I muft furely reckon all exertions difproportioned to the ftrength, and moft of all in the time of weaknefs and convalefcence. Do we not obferve how in fcurvy, upon the fmalleft exertion, the men drop down dead? how when a fhip is in danger, and they are pumping day and night with a weakly crew, thefe alfo fall down dead? Do we not often remember, that after fevers young Men, having made rafh exertions during their ftate of weaknefs, have brought upon themfelves this dreadful difeafe? Do we not fee that boxers, horfe-jockeys, and all the tribe of athletics, cannot make thefe exertions unprepared? And what is their courfe of training, but a fpare diet of generous food, with regular exercife, and gradual exertions; till, at laft, the two great functions of refpiration and circulation accompanying each other, are brought to the higheft pitch; and the man become capable of exertions, before impoffible or dangerous; now familiar and eafy to him? For examples of this danger, let thefe fuffice: A delicate man, little accuftomed to fatigue, having alighted from his horfe and tied it carelefsly, it efcaped; and all day long he chafed it, till, quite exhaufted, he was forced in the evening to give over, breathlefs and palpitating, a hundred times during this vain purfuit. From that day he never had one moment's comfort. In about a year after two throbbing tumours appeared upon his breaft; and, in the courfe of the fecond year when he came to me, thefe tumours covered all the breaft, throbbing in a moft alarming degree, each of them bigger than two fifts. At this time he had walked with tolerable eafe three miles to fee me; but in lefs than four months he was dead, having lived in the greateft mifery.

When I cut out the heart, I took alfo the fternum

 along

along with it. I found an aneurifm of the aorta filling all the cheft, two fair round holes betwixt the cartilages on each fide of the fternum, by which the two tumours were filled; the ribs and fternum were not eroded, but the intervals betwixt the cartilages dilated; the two tumours were, when the fternum was cut away, like two great flat cups, cymbal-fhaped, one a little larger than the other, and each capable of containing about a pound of blood.

It has been known to happen, that a young man, travelling on foot too far, has died in a few days of a prodigious enlargement, with pulfation of the heart. But the cafe which comes neareft to that which I have juft related, is that of a man about 47 years of age, who had fallen into the hands of robbers. Thefe men, unwilling to commit direct murder, carried him into an unfrequented place in the foreft, and there tied him to a tree. Senfible that no human ear could hear his cries, he made the moft violent ftruggles, but without fuccefs. At the diftance of fix hours he was found by a hunter accidentally paffing that way, and faved; but not long, for his ftruggles had produced an aneurifm of the aorta, of which he died. Upon opening his body there were found two aneurifms; one in the arch of the aorta, and one in the left fubclavian artery.

The many cafes in which aneurifms feem to proceed lefs directly from ftrains, blows, falls, and other mifchances, I will not ftop to explain; for a thoufand fuch examples cannot prove that there did not exift an abfolute predifpofition in each individual cafe. But as I began with reprefenting the marks of ill oxydated blood in a child, I fhall conclude with reprefenting the condition of a man, which, even by a regular hiftory, could not be reprefented more faithfully than in this fingle cafe.

I attended, fays Morgagni, the moft excellent Marquis Alloyfis Pallucci, commander of the Pontifical forces at Rome; a man who deferved a longer and a happier life. His difeafe was an aneurifm in the breaft: he could neither lie down, nor go to ftool, nor take nourifhment, but almoft inftantly a paroxyfm was brought on, which threatened

threatened inſtant ſuffocation, and ſometimes ſeemed like death itſelf. He never went to bed; he continually reſted on a chair to avoid all motion; but inſtantly upon the attack of difficult circulation, he would leap from his ſeat, and run to the open window, in hopes of breathing there more freely: yet even there he was uſed to draw his breath with a ſtertor, his face was quite livid, he paſſed his urine and feces without conſciouſneſs; often the breathing was ſo very difficult, ſo interrupted, that even the ſnoring ceaſed, and he ſeemed dead, and fell forwards, apparently lifeleſs, into the arms of the two ſervants who continually ſupported him on either hand. This was the degree of his diſtreſs.

But after all theſe dreadful reports of diſeaſed heart, muſt it not be a comfort for us all to know, that often the moſt ſimple affections, ſuch as we call nervous, from peculiarity of conſtitution, or from ill health, reſemble theſe organic diſeaſes, ſo that all the phyſicians on earth could not pronounce upon the caſe? In ſhort, often thoſe which appear to be at firſt the moſt awful diſeaſes, turn out in truth the moſt trivial and temporary. Palpitations and quick breathing are the moſt uſual ſigns. Palpitations, ſays Sckenkius, may ariſe from tubercles, abſceſſes, or congeſtions of blood; from worms, from ſtones in the heart, from poiſons. But why diſtreſs us with the catalogue of theſe and many other horrible things, till firſt he have explained palpitation to us as a common but merely nervous diſeaſe, which many feel but few complain of?

Were a man to ſtudy only theſe examples of organic diſeaſe, he muſt of courſe believe that there were no other, and think that every palpitation portended death; while palpitation is, in truth, the nervous diſeaſe of boys and girls, of women, or of weakly men: it alarms the young and the robuſt; while, in fact, organic diſeaſe belongs rather to advanced life, and comes ſeriouſly upon us at a time when all fears about palpitations are paſt and over.

I like what Galen ſays (Lib. de Loc. Affect. cap. ii.) "Palpitatio viſceris hujus, pluribus integra valetudine

 degentibus,

degentibus, cum adolescentibus tum adultis, subito, sine ullo alio manifesto accidente, evenire visa est." I think it dangerous to add what follows; "atque omnes eos sanguinis detractio juvit;" for I know such bleeding to be but a temporary relief, more than counterbalanced by a permanent loss. This text I shall explain a very little, and then conclude: for palpitation is, indeed, the disease of boys and of young men, as I have just explained, but not of the aged, in whom chiefly we find organic disease.

Palpitation is like that fluttering which fear brings on; the heart rises in its action till it throbs, and beats against the ribs; it is strongly felt, it is even audible to the bystanders, and still it is but a nervous disease. Its intermissions usually distinguish it from any organic disease; its paroxysms last for many days or weeks; and for weeks or months again it goes quite away. We see it relieved by a jaunt, by living from home and in company, by leaving all business and thoughts of business quite behind: we see the causes which bring it on as plainly as we know the cause of marsh fever, or the plague. The confinement even of a boil will cause it; the confinement of severe study is sure to cause it; and severe study, with an anxious mind, in a young man unused to study; neglected where he is, and at a distance from all his friends, are sure to produce this distress. "My son," says Wierius, "while at Bologna pursuing his studies, had this afflicting palpitation, accompanied with a capricious, frequent, and intermitting pulse; but by bleeding (which the older physicians never neglected), and care, and relaxation from his studies, he got quite well." This is the palpitation which the older authors distinguished by the name of palpitatio cardiaca, marking it as proceeding from the stomach; equivalent, in the language of the present time, to the calling it a nervous disease.

These, then, are the habits in which it occurs, and this its cause: and there remains but two things to be shortly observed, or rather to be proved, viz. that it is sometimes as alarming as an organic disease is; and that bleeding

bleeding is dangerous in an extreme degree, or at leaſt that it does not, as Galen affirms, "always bring relief."

"Sanctius Velaſco, ſon of the Count Velaſco, had a palpitation of the heart ſo terrible, that I and many by-ſtanders often heard it diſtinctly, as if a ſtone had been plumped into a jug half full of water.*" Yet this boy got entirely well, and his phyſicians made themſelves very happy in the thought that they had cured him, by a ſacculus of aromatic herbs ſteeped in wine applied to the region of his heart; and by the ſame aromatics, or cardiacs as they called them, given along with his food.

I prove the ſecond point, viz. the danger of bleeding, by a moſt alarming caſe, delivered by Morgagni, which I fear might (if it had ſo pleaſed the writers) have had in the records of medicine many precedents; it wholly deſtroys the authority of Galen's rule, and plainly inſtructs us never to bleed. "A boarding-miſtreſs, having a ſlighter palpitation of the heart, was bled with ſome appearance of relief: but after two days her palpitations returned with ſuch violence, that the breaſt ſeemed at every ſtroke to be lifted up; ſhe had withal pain, fever, and difficult breathing. They continued bleeding her firſt in the arm, which did no good; then in the foot, which was abſolutely fatal; for in an hour after ſhe died, the pulſe becoming quicker inſtantly, and falling gradually lower and lower, and giving leſs reſiſtance to the finger till ſhe expired." In her viſcera both of the belly and of the thorax, every thing was entire, ſound, and natural; and it had been well for the phyſicians who attended her, had they remembered that the very name of palpitatio cardiaca implies a courſe of proceeding quite the reverſe of this.

Thus the ſimple diſeaſe of nervous palpitation is often ill underſtood, and the patient's health abuſed, and his miſeries and agony of mind, and his real diſeaſe, all in-

* Chriſtoph. a Vegas *Ars Medendi*, lib. iii. ſect. 6. cap. 8.

creaſed, by the ſerious looks of his phyſicians, when, perhaps, it is but a very ſimple caſe.

The French phyſicians, in a very formal conſultation, made a very public miſtake of this kind, in the diſeaſe of Marinus de Caballis, ambaſſador at Paris from the Venetian ſtate. He complained to them of his palpitation and of his intermitting pulſe; and they concealing nothing of their opinion from him, prognoſticated the very worſt; adviſed him to demand his audience of leave, to go off for his native country, and there to make his will, ſettle all the affairs of his family, and then compoſe himſelf for his laſt hour. Having obeyed them in all things, he arrived in Italy very diſconſolate and dejected, and their prognoſtic was well nigh fulfilled. But, like a man who would have another throw for one precious ſtake, he called a conſultation of the college; among whom, happily, was Victor Trincavelli, then profeſſor in the univerſity of Pavia; who, perceiving that ſuch tremors of his pulſe proceeded entirely from the great charge of important matters which lay heavy upon his mind, aſſured him of recovering his health. He ordered frequent bleedings, which the peculiar fulneſs of his habit ſeemed to require; and by cordial medicines he was entirely reſtored, and lived long;—a man of great ſcience, and ſkilful in many languages. After this ſad journey, he performed with much honour to the ſtate two ſplendid embaſſies to the Emperor and to the Turks.

Let no one in future pronounce ſo raſhly; it is time alone, and various modes of living, that can explain to us whether there be in any individual caſe a fixed diſeaſe. Nor would I dare to ſpeak of the organic diſeaſes of the heart, without explaining more fully an idea which Albertine has ſhortly and ſimply expreſſed. "Formerly, in diſeaſed reſpiration, any vitiated ſtructure of the heart and precordia were unheard of; but after obſervations being ſeveral times repeated in dead bodies, the ſame names are too much heard of and too much dreaded in the living.

BOOK

BOOK II.

OF THE ARTERIES.

GENERAL PLAN OF THE ARTERIES.

AORTA.

THE arteries of all the body, (excepting only thoſe of the lungs employed merely in oxydating the blood) ariſe from one trunk, the aorta; which we muſt deſcribe as of great ſize, ſince we compare it with other arteries, but which is wonderfully ſmall, conſidering that it is of its branches only that the whole body is compoſed.

Thoſe will have the trueſt notion of the diſtorted form of the aorta who have ſtudied the anatomy of the heart. Its root is deep buried in the fleſh of the heart. In the Tortoiſe we ſee the fleſh of the heart riſing round the root of the aorta, and endowing it with the power of a ſecond ventricle: in the Frog we find its internal ſurface beſet with a triple row of valves, and its coats are like thoſe of a ventricle, they are ſo exceedingly ſtrong: in Man we find it plainly muſcular, ſurrounded in circles with great fibres, and having much muſcular power.

The beginning of the aorta, then, lies deep in the fleſh of the heart; it is there that it gives off its coronary arteries; it bulges at its root into three great knobs, which mark the place of its three valves, and are called the leſſer ſinuſes of the aorta; it is large at the root, it grows ſmaller as it riſes, it mounts upwards and back-

wards from the heart, till it begins to form its arch or curvature; its direction is firſt towards the right ſide of the thorax; looking backwards, it turns in a very diſtorted manner, where it forms the arch; it ſtrides over the root of the lungs, going now to the left ſide and backwarks, till it touches the ſpine; its arch lies ſo upon the forking of the trachea, that its aneuriſms often burſt into the lungs: it then applies itſelf cloſe to the ſpine, ſo that in aneuriſms the preſſure of the aorta often deſtroys the vertebræ; and now lying along the left ſide of the ſpine, and with the œſophagus running cloſe by it, it paſſes down through the thorax, and from that to the belly under the legs of the diaphragm.

This, then, may ſerve as a ſhort deſcription of the aorta, which is the root of all thoſe arteries which we proceed now to explain. Its ſtructure is ſtrong, muſcular, and continually active, performing the office of a ſecond heart. When in old age it begins to loſe this muſcular power, to have its fibres embarraſſed with chalky, or as they are called bony concretions, it is no longer able to reſiſt the force of the blood; it is not dilated into aneuriſms, becauſe of the acute angle which it makes, and the direct impetus of the blood, for many other arteries turn backwards with very acute angles; the arteries tied in aneuriſms, amputations, and on other occaſions, do not dilate; the inoſculations which ſave a limb after the operations for aneuriſm, receive the blood in a retrograde courſe, and the angles are often very acute, yet they do not dilate too much. The arteries under joints are oftener bent than ſtraight; the aorta of deformed people follows cloſely the deformity of the ſpine, and makes ſuch ſingular angles, that after once ſeeing them no one will talk of angles occaſioning dilatation. The aorta, when dilated, in nine of ten caſes is covered with white ſpots; it is diſeaſed; they are aged people, and almoſt always the dilatation begins from the heart.

The aorta, then, is the trunk from which the general tree of the arteries is to be explained.

From the arch of the aorta go off three great arteries, which riſe to the head, or bend ſidewiſe towards the arms, and ſo nouriſh all the upper parts of the body. Of theſe three arteries, the firſt is a great one, which contains, if I may ſo expreſs it, the RIGHT CAROTID and the RIGHT SUBCLAVIAN, and divides ſo as to form thoſe two arteries, about one inch after it ariſes from the arch; the next is the LEFT CAROTID ARTERY going to the head; the third is the LEFT SUBCLAVIAN, going to the left arm. Theſe three branches occupy all the arch of the aorta.

RICHT SUBCLAVIAN.

The right ſubclavian goes off from the aorta in a more direct courſe than the left; it is thought to receive the blood more fully; perhaps, alſo, it is rather larger than the left ſubclavian: but, at all events, there is ſomething peculiar in the mechaniſm of the right arm; moſt probably it is the peculiar form or direction of this artery that gives to the right arm a ſuperior dexterity and ſtrength. When Horſes are to be broken, we find the chief difficulty to conſiſt in teaching them to move equally with both feet, for they prefer the right; when a Dog trots, or when he digs the ground, he goes with his right ſide foremoſt, and digs chiefly with his right foot; and in theſe creatures we find the ſame arrangement of theſe arteries as in ourſelves. But in Birds, where an equal balance of ſtrength is required for the wings, both ſubclavian arteries are diſtinct branches of the aorta. When we loſe our arm, the left hand acquires by uſe all the ſtrength and dexterity of the right. Since, then, either arm can acquire this dexterity, and ſince the right leg is ſtronger by its dependence upon the motions of the right hand, we have every reaſon to believe, that the preference given to the right hand has ſome phyſical cauſe, and that it is the peculiar form of this artery, viz. going off more directly on the right ſide,

and

and that thoſe who are ambidexter muſt have the right as well as the left ſubclavian going off as one independent branch.

There is another peculiarity which has occurred. The arch ſometimes gives out four branches, and the left ſubclavian, ariſing firſt from the arch, has paſſed behind the trachea, betwixt the trachea and the œſophagus. The ſubject dying of difficult deglutition, which has ſubſiſted from childhood, it has been attributed to the preſſure of this preternatural artery, an effect which I cannot eaſily believe; and it has been propoſed to rank it as a new and certainly incurable ſpecies of the diſeaſe, under the title of dyſphagia luſoria, as ariſing from a luſus naturæ of this artery.

CAROTIDS.

THE next branch of the arch is the LEFT CAROTID. The two carotids mount along the ſides of the neck, are felt beating ſtrongly, and ſeem much expoſed. They retire for protection behind the prominency of the thyroid cartilage. They divide into external and internal carotids under the angle of the jaw. The EXTERNAL CAROTID ſupplies the neck, the face, the inſide of the throat; and the reader will have chiefly to obſerve its courſe all along the neck, its branching at the angle of the jaw, and the operations and wounds about the throat, neck, face, and eſpecially about the root of the ear.

LEFT SUBCLAVIAN.

THE left ſubclavian is the third branch of the aorta. Each ſubclavian artery varies its name according to the parts through which it goes. This great artery of the arm is named SUBCLAVIAN under the clavicle, where it gives branches to the neck; AXILLARY in the arm-pit, where it gives branches on the one hand to the ſcapula, on the other to the breaſt. It is named BRACHIAL where it runs down the arm, and where there are few important branches; and, finally, its branches, into which it divides at the bend of the arm, are named RADIAL,

ULNAR,

ULNAR, and INTEROSSEOUS, becauſe they reſpectively run along theſe parts, the radius, the ulna, and the interoſſeous membrane.

THORACIC AND ABDOMINAL AORTA.

THE aorta, after completing its arch, paſſes through the thorax, giving but few branches, and thoſe very ſlender. But the ABDOMINAL AORTA, as ſoon as it has emerged from under the legs of the diaphragm, gives three great abdominal arteries: Firſt, the CÆLIAC, going in three branches to the liver, the ſtomach, and the ſpleen; ſecondly, the SUPERIOR MESENTERIC, which furniſhes all the ſmall inteſtines; and thirdly, the lower MESENTERIC, which ſupplies moſt of the great inteſtines down to the rectum. The arteries of the kidneys and of the teſticles follow theſe, and then the aorta divides into two great branches for the pelvis and legs.

The ILIAC ARTERIES are the two great branches into which the aorta divides within the abdomen, and theſe again are each ſubdivided into two great arteries; the INTERNAL ILIACS to ſupply the pelvis, the EXTERNAL ILIACS to go to the thigh.

INTERNAL ILIACS.

THE INTERNAL ILIAC ſupplies the bladder, the rectum, the womb, with leſſer arteries; but its great arteries go out by the openings of the pelvis to ſupply the very large muſcles of the hip and thigh. Thus the the GLUTÆAL, a very great artery, turns round the bone, goes out by the ſciatic notch, and goes to the glutæal muſcles. The SCIATIC, almoſt equally large, turns down along the hip oppoſite to the glutæal, which turns up. The pudic, of great ſize, alſo turns out of the pelvis, turns inwards again towards the root of the penis, and belongs entirely to the private parts, as its name implies.

EXTERNAL ILIACS.

THE EXTERNAL ILIAC, when it paſſes out of the abdomen, takes the name of FEMORAL ARTERY: it divides into

into two vaſt arteries a little below the ligament of the thigh: the one goes deep, belongs to the muſcles, is called the PROFUNDA; it furniſhes all the thigh, and it it might with the ſtricteſt propriety be named the femoral artery. The FEMORAL ARTERY, as we call it, is the other great branch, which continues ſuperficial, runs obliquely down the fore part of the thigh, gives few and but trivial branches to the thigh, and is really deſtined for the leg. When the artery turns inwards towards the ham, it is named POPLITEAL ARTERY; and, like the artery at the bend of the arm, this one at the bending of the knee divides into three great branches, which, like thoſe of the arm, take their names from the bones along which they run; the ANTERIOR TIBIAL ARTERY lies on the fore part of the tibia; the POSTERIOR TIBIAL ARTERY runs along the back part of the tibia; the FIBULAR ARTERY runs along the fibula; and theſe great arteries terminate by making arches with each other in the ſole of the foot, in the ſame manner that the RADIAL and ULNAR ARTERIES join in great arches in the palm of the hand.

This ſlight plan I have choſen to throw out before my reader, that the ſucceeding parts may ſeem more methodical, and that he may have at a ſlight glance the chief parts of his taſk before him; and knowing all his duty, he cannot be inattentive to that on which the lives of his fellow-creatures muſt ſo often depend.

CHAP.

CHAP. I.

OF THE ARTERIES OF THE HEAD.

SECT. I.

OF THE CAROTID ARTERIES IN GENERAL.

THE carotid arteries are alſo named the Arteriæ Cerebri, as if they were the ſole arteries of the brain; and the ancients, either ignorant or forgetful of there being any other arteries for the brain, or not obſerving that the vertebral arteries might convey blood enough for the functions of the brain, did actually name the carotids the Arteriæ Soporiferæ; believing that, if they were tied, the perſon muſt fall aſleep *. How a perſon might die from having the great arteries of the head tied, I can moſt readily conceive; but how he ſhould rather fall aſleep, and not die, is quite beyond my comprehenſion: and yet many of the beſt anatomiſts, in the beſt age of anatomy, have abuſed their time repeating theſe experiments. Vaſalva, Van Swieten, Pechlinus, Lower, and eſpecially Drelincurtius in his Experimenta Canicidia, and many others, ſpent days and weeks in tying up the carotids of Dogs. What does all this imply? Surely a ſtrong belief in tales which would diſgrace the Arabian Nights; tales concerning a manner of tying a cord round the neck of a She-goat, or even of a young Man, ſo that, without hurting them, they ſhould be made to ſleep or wake, according to the bidding of the ſpectators.

Coſtæus firſt tells this tale: "Circumforaneous mountebanks (ſays he †) often perform this miracle. They tie a ligature round the jugular veins of a She-goat; and they tighten it and relax it from time to time, ſo that at

* The name which we uſe, viz. that of carotids, is ſynonymous in Greek with Arteriæ Soporales.

† Diſquiſitiones Pathologicæ, lib. 6. cap. 6.

their

their pleaſure the animal falls down motionleſs and ſtupid, and at their bidding leaps up again with great vigour.' The moſt incredible tales ſoon followed, and ſoon crept into otherwiſe good and uſeful books. Even Hoffman ſeems not unwilling to believe that the Aſſyrians had been in uſe of tying up the jugular veins in their young men before circumciſion, that they might feel leſs pain. A ſerious operation, God-wot! for ſo ſlight a cauſe. Even Morgagni talks more ſeriouſly of the She-goat, and of this ſnibbing of the young men of Aſſyria, than one could wiſh in reſpect to the character of one ſo truly great as Morgagni *. But the perſon the moſt celebrated in this affair was Realdus Columbus; and the wildeſt and moſt barefaced tale that ever was told, is that delivered by his pupil Valverdus in his Anatomy of the Human Body.

"The carotid arteries (ſays Valverdus) being tied up, or any how obſtructed, the perſon grows ſtupid, and falls preſently into a profound ſleep. This experiment I ſaw at Piſa in the year 1554. It was performed upo na young man by the celebrated Columbus in the preſence of a great many gentlemen and ſtrangers, with no leſs miſery to them than amuſement to us (the pupils), who, though we knew the cauſe, aſcribed it altogether to the black art." But if any one word of this were true, Valverdus would have told us, and been proud to tell us, by what particular operation, ligature, or preſſure, this ſtrange thing was performed; and Columbus himſelf, the author of this new amuſement, would ſurely have dropped ſome hints about it in ſome place or other of his works.

* The celebrated Cant not only believes this moſt powfully, but reaſons upon it in the following manner: "Ruffus Epheſius, lib. 1. cap. 34. hanc ſoporem adferre negat, hinc aliud nomen permitteret; ſed Realdus Columbus publice in theatro demonſtravit hunc effectum præſtari hac arteria: itaque nomen retinebimus, UTPOTE rei CONGRUENS. Sic enim quotidie experimur poſt prandium ſomnolentiam, quam facile deducere poſſumus ab effectu hujus arteriæ; nam ventriculo extenſo premitur aorta deſcendens, quo ſanguis copia majori ruit in carotides; quæ hinc extenſæ comprimunt cerebrum quodammodo, quo motus animales non ita expedite abſolvuntur, verum vitales augentur motus, quæ ambo fiunt in ſomno." *Tab. Cant impetus faciens*, p. 6.

works. But from the modeſt ſilence of the maſter and the ſecrecy of the pupil, we have reaſon to believe it is untrue; and if Columbus did ever venture to exhibit ſuch a mean piece of legerdemain, he put himſelf quite upon the level with the quack and his She-goat. The quack, indeed, was much beyond him in point of merit, ſince it muſt have been far eaſier to teach a clever young Man to fall down or ſtart up than to teach all this to a She-goat.

Galen has explained it well, ſaying, "that phyſicians and philoſophers, tying the carotid arteries, tie in along with them the recurrent nerves which ſerve for the voice; and if they will have ſilence to be ſleep, no doubt the creature is mute after their awkward operation; but no other function is hurt neither then nor afterwards."

This is the truth, and the whole truth nearly; for if but one Dog lives after both carotids are tied, nothing can be more certain than that thoſe which die muſt have ſuffered by ſome awkwardneſs or diſeaſe. Is it wonderful that, after ſuch a cruel tedious operation as this is, the Dog ſhould be exhauſted, ſhould be weakened by loſs of blood, ſhould feel ſore, and hang his head and droop, and let the ſlaver fall from his jaws? that he ſhould ſkulk in corners, look ſidelong, be jealous, and not eaſily moved from his hole? Theſe are what they have thought fit to call drowſineſs and ſigns of ſleep; but it is ſuch drowſineſs and ſuch ſleep as would have followed ſuch a cutting-up of the creature's neck, whether the experiment-maker had touched the carotids or not. The creature lolls its tongue, hangs its head, cloſes its watery and heavy eyes, is drowſy, or, in other words, feveriſh for many days: It eats with all the voracity of a Dog, but with difficulty, and ſlowly, owing to the ſwelling of its throat; and if it dies, it dies from the ſame cauſe. Nothing is more certain than that theſe are the only particular effects, and that the carotids of a Dog may be tied without any other danger than that of the wound.

There is nothing new under the ſun. We are continually tantaliſed with old tales in new forms. Who

would

would expect to find at this very day a practical application of the She-goat and the Assyrian young Men? One author has published to the world, "that a young Lady, of a nervous and delicate constitution, subject to nervous distresses in a wonderful variety of forms, but more especially in the head, sometimes afflicted with headachs, sometimes with delirium, sometimes with convulsions, was relieved by compressing the carotid arteries." Often by compressing the carotid artories, this gentleman prevented the delirium; "for all these complaints proceeded from a violent palpitation of the heart with the stream of blood rushing violently towards the head." He has seen this compression bring on a stupor; he has seen it bring on a profound sleep. Is it not a pity that he had not attended more to the history of this business, and joined to these facts the story of the She-goat and the young Men of Assyria?

If what Dr. Parry says be true, that in lean people, in women at least, we can, by reclining the head backwards, compress the carotids entirely against the fore-part of the neck with the finger and thumb; why, then, we need have no fear of hemorrhagies of the nose, wounds about the jaw, cutting the parotid gland, or operations about the tonsils or tongue! But there is a dangerous mistake here; for there is (as I know by much experience) a wide difference betwixt preventing the pulse of an artery and suppressing the flow of blood through it. In the case of a Man fainting during any great operation, if you are holding in the blood with the point of your finger upon some great artery, you feel the pulse there, while the face is deadly pale, the extremities cold, and the pulse of the wrist and of all but the largest arteries gone. In fainting, even the heart itself is not felt to move; and yet it moves, and the blood circulates: how else could a person lie in a hysterical faint for hours, I had almost said days? I have tried, in great operations near the trunk of the body, to stop the blood with my hands; but though I could suppress the pulse of the femoral artery with my fore finger, I could not command its blood with the whole strength of my body, but

have feen it with horror rufh as freely as if my hand had not been there. In fhort, I fufpect Dr. Parry's belief of his ftopping the carotids with his finger and thumb is as vain as Dr. Monro's expectation of compreffing the abdominal aorta by pufhing with his fift againft the belly.

THE CAROTID ARTERY, having emerged from the cheft, runs up along the neck by the fide of the trachea, a fingle undivided artery, without twig or branch, till it touches the jaw. The length of this artery gives us a fair opportunity of obferving, of proving, if we choofe, that arteries are cylinders, and not, as they once were fuppofed, of a conical form. But the cylindrical form of this artery fhould not occupy our attention fo much, as that peculiarity of direction, which, though apparently expofed, keeps it fafe; or thofe important connections which make it fo dangerous either to cut or to tie this artery.

Firft, The carotid artery, from the place where it emerges from the cheft up to the angle of the jaw, is continually receding from the fore-part of the throat, is getting deeper and deeper by the fide of the trachea, at laft the ftrong projection of the larynx or cartilaginous part of the tube defends it; and when it has got to the angle of the jaw, it lies there fo deep under the ear, betwixt the ear and the jaw, in a fort of axilla, as we may call it, filled with fat and glands, that it is almoft out of reach of danger, unlefs it be fometimes of the furgeon's knife, but rarely of wounds.

This continual retreating of the carotid artery, deeper and deeper as it rifes along the neck, faves it from the attempts of fuicides: it is rarely cut, or when cut, it bleeds fo that no ignorant perfon can command it, and the furgeon is too late. But although tumours and aneurifms are rare, and through unwillingnefs and a well-grounded fear fuch patients are ufually left to take their fate; yet there may happen cafes in which it may be neceffary to do fo bold a thing as to tie this artery.

Secondly, The connections of the carotid, as it rifes along the neck, muft determine our judgment, if ever any fuch cafe fhould occur. To ftop the growth of an aneurifm, to allow the extirpation of other tumours about the jaw, to fave a patient from dreadful bleedings of the throat, or from the hemorrhagies of deep wounds, when, for example, a patient is ftabbed in the neck, or a ball paffes through the mouth and under the angle of the jaw; thefe may, in fome unlucky moment, prefent themfelves as motives for tying the trunk of this artery, when all its great branches are torn. But always the obfervation of Galen is to be remembered, that the nerves accompanying thefe arteries are liable to be tied together with them.

Let us recollect how the carotid artery, jugular vein, and eighth pair of nerves, come out from the fkull, for it is almoft at one fingle point. The carotid artery enters by a hole in the petrous bone; the jugular vein comes out by a larger hole in the fame bone, the foramen lacerum; immediately behind it the eighth pair of nerves, or the par vagum, goes out through a divifion of the fame foramen lacerum, feparated from the vein only by a little crofs flip of the dura mater; and fo the carotid artery, jugular vein, and eighth pair, touch each other at the bafis of the fkull. Through the whole length of the neck they continue the connection which is thus early begun. They are, indeed, inclofed in one fheath of cellular membrane; fo that what touches the one almoft inevitably affects the other. The par vagum being the great nerve of the vifcera, at leaft of the ftomach, strictures upon it or wounds are certainly fatal. A furgeon might eafily, if it were poffible for him to be called in time, take up the gaping mouth of the artery fafely when it were cut acrofs; yet in moft of fuch cafes the nerve being alfo cut, the operation would be fruitlefs. But as for a deliberate diffection of the fkin, the artery beating furioufly, and the parts embaraffed with any tumour, and the operator alarmed with a deluge of blood from the veins; that, I think, would be a bold ftep. In fhort,

ſhort, the neceſſity of any ſuch operation is reduced to the accident of tumours or wounds about the angle of the jaw; in which caſes, the ſponge thruſt down into the wound will almoſt always check the blood.

When the common carotid has riſen to the angle of the jaw, it divides into two great arteries, one going to the outſide of the head, the other to the brain; the one of courſe named the EXTERNAL, the other the INTERNAL CAROTID. Some of the moſt eminent anatomiſts are incorrect when they ſay, that the carotid artery gives no branches till it arrives at the larynx. They ſay ſo becauſe the firſt branch goes to the larynx; but, in fact, the carotid paſſes much beyond the place to which it is to give its firſt branch, for inſtead of branching at the larynx, it does not do ſo till it arrives at the corner of the jaw; there, as I have obſerved, it can, as in an axilla, lie deep and ſafe; and the laryngeal artery, which is the firſt branch of the carotid, turns downwards again to touch the larynx.

The firſt diviſion, then, of the carotid artery is into the external and internal carotids; and the external carotid gives branches ſo intereſting to the ſurgeon, yet ſo numerous, that it is at once very deſirable and very difficult to get a knowledge of each: arrangement is here of more importance than in any order of arteries, though extremely uſeful in all.

ARRANGEMENT OF THE BRANCHES OF THE EXTERNAL CAROTID ARTERY.

THE external carotid gives three ſets of arteries; each of which, having a plain and diſtinct character, cannot be forgotten, nor their direction, nor their uſes, nor their relative importance, miſconceived; for if we conſider but the parts along which the carotid artery paſſes, as 1. The thyroid gland; 2. The tongue; 3. The face; 4. The phraynx; 5. The occiput; 6. The ear; 7. The inſide

inſide of the jaws; 8. The temple:—if we remember thus the order of theſe parts, we ſhall not forget the order in which the branches go off.

But it will be further very uſeful to obſerve, that theſe many branches divide themſelves moſt naturally into three ſets.

1. The branches which go off from the carotid forwards are peculiary important; one of them goes to the thyroid gland, another to the tongue, and a third to the face; parts which, to ſay no more, are peculiarly expoſed; but they are, beſides, the ſubject of many particular operations.

2. Thoſe branches which go backwards and inwards, as the pharyngeal, the auricular, and the occipital arteries going to the ear the pharynx and the occiput are both extremely ſmall, and alſo run ſo deep, that wounds of them are rare and of leſs importance, and fortunately thoſe branches are the only ones which it is difficult to remember.

3. The great artery which paſſes behind the lower jaw, named maxillary artery, and the temporal artery which lies behind the jaw, imbedded in the parotid gland, muſt be ſtudied with particular care; the difficulty of cutting tumours here, the courſe of the temporal artery in which we bleed, and which, lying imbedded in the parotid gland, demonſtrates the abſurdity of talking about cutting out the parotid gland, ſince plainly it cannot be done; and, laſtly, the terrible hemorrhagies which often happen from the throat, noſe, tonſils, &c. gives an importance to theſe two branches above almoſt any other. They ſhould be very familiarly known to the ſurgeon.

Theſe, then, are the three diviſions of the external carotid artery which are to be deſcribed.

FIRST ORDER,

INCLUDING the arteries which go forward to the thyroid gland, tongue, and face.

1. ARTERIA THYROIDEA.

THE THYROID ARTERY, often alſo named the upper laryngeal artery, comes off from the external carotid almoſt in the very moment in which it ſeparates from the internal carotid. Its place is behind the angle of the jaw; it goes downwards and forwards in a very tortuous form, till it arrives at the thyroid gland, upon which it is almoſt entirely expended; but yet it gives ſome branches, or rather twigs, of which the following are the chief:

1. One ſuperficial branch goes upwards to the os hyoides, and ſends its twigs ſometimes under, ſometimes over, the os hyoides: it belongs chiefly to that muſcle and to that piece of membrane which join the os hyoides with the thyroid cartilage, named muſculus hyothyroideus. This branch is both long and beautiful; it meets its fellow of the oppoſite ſide with free inoſculations; it ſupplies cutaneous twigs, and twigs to the platiſma myoides.

2. A ſecond ſuperficial twig goes downwards to the lower part of the thyroid cartilage, where it meets the cricoid, and there gives little arteries to the maſtoid muſcle, jugular vein, and ſkin.

3. There is another branch which proceeds frequently enough from this ſecond one: it belongs entirely to the larynx, for which reaſon the thyroid is often named the ſuperior laryngeal artery: it dives immediately betwixt the cartilages of the larynx; it enters betwixt the thyroid and cricoid cartilages, carries in along with it a twig from the eighth pair of nerves; it gives its twigs to the epiglottis, and to all the ſmall muſcles which lie under cover of the thyroid cartilage, and which move the little arytenoid cartilages; and then paſſes outward emerging

from the larynx, and appears again supplying the cricothyroideus muscle.

4. The fourth branch of the thyroid is properly the main artery, or continuation of this branch into the substance of the thyroid gland; it applies itself to the side of the gland, nourishes its substance by a great many small branches into which it is divided. These branches are all oblique, tending downwards and forwards. Their course is upon the side of the gland, because, indeed, the gland consists chiefly of two lateral lobes, and hardly any of the gland, or only a small portion crosses the trachea; consequently this artery does not inosculate so much with its fellow of the opposite side as with the lower thyroid, which comes from the subclavian artery, and whose branches, mounting upon the lower part of the gland, have pretty nearly the same degree of obliquity with those of the upper thyroid.

2. ARTERIA LINGUALIS.

THE LINGUAL ARTERY is one of which the four branches are nearly of an equal size, and which of course require all of them to be equally well remembered. It is next to the thyroid, comes off immediately above it, goes forwards towards the os hyoides, and at the same time upwards towards the tongue; but all along it lies flat upon the side of the tongue upon its flesh or muscles, and gives the following branches.

1. Upon passing the horn of the os hyoides, it gives first one twig of less note backwards to the constrictor pharyngis, at the place where that constrictor arises from the horn of the os hyoides (viz. the constrictor medius); and it gives another branch forwards round the basis of the os hyoides, where it meets its fellow: and to those who are acquainted with the muscles which arise from the os hyoides, it is needless to say what muscles it supplies *. This, which is named the RAMUS HYOIDEUS, seems to be very necessary, because it is a very constant

* Viz. the hyo-glossus, digastricus, mylo-hyoideus, the coraco-hyoideus, sterno-hyoideus, and hyo-thyroideus.

branch;

branch; and when it does not come from the lingual, it infallibly arises from some other, commonly from the labial artery.

2. DORSALIS LINGUÆ is a branch which goes off from the lingual at the insertion of the stylo-glossus muscle into the tongue: it turns first outwards a little, and then inwards over the root of the tongue, where the arteries of the opposite sides meet, and form a sort of network. Its chief branches are directed backwards towards the epiglottis and mouth of the pharynx, amygdalæ, &c.

About the middle of the tongue, or about half way to the chin, measuring along the jaw, the lingual artery forks into two branches; the one below the tongue, the sublingualis, belongs to the sublingual gland and surrounding parts; the other remaining at the root of the tongue, belongs to the tongue itself.

3. SUBLINGUALIS then arises next; it comes from the side of the artery next the tongue; it runs under the sublingual gland, covered like it by the genio-hyoideus muscle, and emerges only when it arrives at the chin, where it terminates in the skin. Its branches are chiefly to the sublingual gland, which lies over it, and to the genio-hyoidei and mylo-hyoidei muscles and skin, for these are the parts which immediately cover it.

4. The ARTERIA RANINA is the larger branch of these two; it runs along the root of the tongue quite to the tip of it. In this course it is accompanied by its vein, which appears on the inside of the mouth when we turn up the tip of the tongue. This is the vein which the older physicians were so fond of having opened in sore throats; the artery is that which we are so apt to cut in dividing the frenulum linguæ; an awkwardness from which a great many children have died.

N. B. It runs along the genio-glossus, which is the innermost muscle of the tongue.

3. ARTERIA LABIALIS.

THE labial artery is named occasionally the EXTERNAL MAXILLARY artery, to distinguish it from one which

goes

goes off at a higher point, and goes to the inſide of the jaw; or ANGULARIS, becauſe it goes to the corner of the mouth and there divides; or FACIALIS, implying, that it ſupplies the face, as indeed it does as far as the angle of the eye and forehead, where there are other ſmall arteries. Haller adheres to this name of LABIALIS, and in compliment to him we adhere to it.

This artery is ſtill carefully kept down in the deep angle; although it is to come out upon the jaw, yet it is not expoſed till it actually makes its turn: it lies under the ſtylo-hyoideus and the tendon of the digaſtric muſcle: it is very tortuous, that it may move along with the jaw, and lies ſtill ſo deep, even when it approaches the jaw-bone, that it is forced to make a very violent and ſudden angle when turning over it. This ſudden turn, which is ſometimes almoſt a circle, is made, as it were, in the heart of the great ſub-maxillary gland, the artery being buried under it. The labialis is a very large artery, very tortuous; ſometimes one great trunk gives off two important arteries at once, the lingual and the facial; in which caſe they ſeparate juſt at the angle of the jaw, where the artery, dividing the ſubſtance of the gland, is quite imbedded in fat. When we conſider how deep this artery lies according to this general deſcription, and the parts which it paſſes along, it becomes eaſy to foreſee what branches it will give, and to trace them in imagination.

1. Where it lies the deepeſt upon the ſide of the pharynx, it ſends a branch directly upwards, which goes ſtraight to the arch of the palate, ſpreading its ſmall twigs upon the arch of the palate, upon the velum palati and upon the uvula: it uſually has two ſmall branches for ſupplying theſe parts, one ſuperficial and one deep; and thus the labial gives a particular artery to the palate, named ARTERIA PALATINA INFERIOR.

2. It gives a particular artery to the tonſil, which ariſes at that point where the ſtylo-gloſſus begins to mix with the other muſcles of the tongue. This little artery penetrates the walls of the pharynx upon which it lies, and ſpreads its many twigs upon the tonſil and tongue.

3. While

3. While paſſing through the ſub-maxillary gland, dividing it, as it were, into two parts, the labial artery gives a great many ſmall twigs into the ſubſtance of the gland itſelf; and after theſe it gives many twigs to the tongue, the ſkin, the muſcles, &c. Of theſe, two chiefly are remarkable; one, which goes to the pterygoid muſcle chiefly, though it alſo gives branches to the conſtrictors of the fauces and palate, and to the root of the tongue; and another artery, more conſtant and regular, which breaks off at the place where the labial artery curls and bends to turn upwards: it runs ſuperficially, and goes ſtraight forwards to the root of the chin, where it is named ARTERIA SUBMENTALIS: it turns upwards over the chin to the face at the middle of the chin, and often inoſculates with ſome of the arteries of the face: it ſometimes comes from the ſublingual artery.

But the artery having emerged from betwixt the lobes of the ſub-maxillary gland (for this artery in a manner divides it into lobes), and from among the fat with which it is ſurrounded, makes a ſudden turn over the angle of the jaw at that point where we feel it beating ſtrongly; and then mounting upon the face, begins to give a new ſet of arteries.

1. A branch to the maſſeter muſcle; for the labial artery paſſes over the jaw, and up the face, juſt at the fore edge of the maſſeter muſcle; and this branch inoſculates with a twig deſcending over the ſurface of the maſſeter from the temporal artery.

2. The labial artery aſcending in the hollowest part of the cheek, and lying flat upon the buccinator muſcle, gives out ſmall branches to it, which inoſculate chiefly with the tranſverſalis faciei, another branch, and a conſiderable one, coming from the temporal artery acroſs the face. Here alſo the main artery has ſtill a very ſerpentine line, on account of the continual motions of the part.

3. Before the artery comes to that point where it is to give off the coronary artery of the lower lip, it gives a branch named labialis inferior; which artery belongs to

to the lower part of the lower lip: its branches go to the triangularis and quadratus mufcles, which lie on the chin and on the fide of the chin, and alfo to the lower part of the orbicularis oris. This branch inofculates particularly with a twig, which comes from within the lower jaw through the mental hole, and with its fellow, and of courfe with the coronary arteries which run immediately above it, viz. in the red part of the lip.

The artery now divides into two branches, one for each lip, named the CORONARY ARTERIES, becaufe they always furround the lips entirely, though their manner of going off is not perfectly regular. The lower coronary artery is ufually fmaller, and is to be named the branch, while the upper one not only furrounds the lip, but mounts along the fide of the nofe; it is larger; and is therefore to be confidered as the continued trunk. We frequently obferve the upper coronary larger on one fide of the face, and the lower coronary larger on the other.

4. The LOWER CORONARY comes off about an inch or more from the angle of the mouth, at that point where the triangularis oris and many other mufcles meet. It goes directly forwards to the angle of the mouth, enters into the lower part of the lip, and runs along the red pulpy part of it, where with the finger and thumb it can be felt beating. It inofculates with all the arteries formerly mentioned; as the fubmental, the twig which comes through the hole near the chin, the inferior labial artery, and with its fellow. With all thefe it inofculates fo freely, that it fignifies little from which fide your injection is driven: it goes freely all round the lips, and the arteries are every-where equally filled.

5. The UPPER CORONARY ARTERY we are to confider as the continued trunk. The labial artery is ftill rifing, and ftill tortuous, when it arrives at the angle of the mouth; runs into the border or flefhy part of the upper lip, and runs along it till at the middle of the lip it meets its fellow of the oppofite fide, with a very free inofculation: yet the two arteries do not terminate here, but ufually two very delicate arteries afcend towards

wards the point of the noſe, along that little ridge from the noſe to the lip which we call the filtrum; and almoſt always a conſiderable artery runs up from the ſuperior labial artery by the ſide of the noſe. From this is given off a branch to the noſe, viz. the NASALIS LATERALIS, and now the artery ſtill aſcending (under the name of ANGULARIS), gives off branches to the cheek and eye-lids, and growing gradually ſmaller, it arrives at laſt near the angle of the eye, and inoſculates pretty freely with that artery, which is named ophthalmic, becauſe it firſt nouriſhes the parts of the eye with many branches, and then comes out of the orbit at the corner of the eye, where, though ſmall, it may be felt beating diſtinctly.

SECOND ORDER.

THE ſecond ſet of arteries, which go backwards from the external carotid, comprehend the pharyngeal, the occipital, the auricular.

4. PHARYNGEA INFERIOR.

THE LOWER PHARYNGEAL* is a ſmall ſlender artery, which gives no branches deſerving to be numbered; it ſtands alone, and ſhould be deſcribed as one ſimple artery, whoſe ſmall branches ſpread all about the throat in the following manner.

This artery is ſmaller than any other branch of the carotid yet enumerated. It ariſes oppoſite to the lingual artery; and as it ariſes from the inner ſide, it comes out in a manner from the fork betwixt the external and internal carotid arteries: it riſes upwards very ſlender and delicate: it lies deep in the neck, upon the fore-part of the flat vertebræ, or rather lies upon the flat face of the longus colli muſcle †. After riſing in one ſlender

* It is named lower pharyngeal, to diſtinguiſh it from one which comes downwards from the internal maxillary.

† When diſſected, it muſt be taken out in a manner from behind the œſophagus. The carotids muſt be raiſed outwards before it can be ſeen; for it lies under them, betwixt them and the throat.

artery,

artery, single, without branches or connections, it begins all at once to give twigs.

First, It gives branches inwards to the throat; for one twig surrounds the lower part of the pharynx about the root of the tongue, and sometimes goes forwards along with the glosso-pharyngeal nerve into the tongue. Another twig goes to the middle of the pharynx, and wanders towards the velum palati, giving branches to the amygdalæ. And still another goes higher towards the basis of the skull; it also gives twigs to the velum palati, to the back of the nostrils, to the upper part of the pharynx where the upper constrictor lies (viz. that which comes from the basis of the skull), and it gives small arteries to nourish the basis of the skull; as, to the os sphenoides, to the cuneiform process of the occiput, to the point of the temporal bone, and to the cartilage of the Eustachian tube.

Secondly, It sends branches outwards to the mastoid muscle, to the jugular vein, to the ganglion of the intercostal nerve, and to the dura mater of the eighth pair; and one particular branch, very small and delicate, goes along conducted by the great jugular vein, enters together with it into the skull, and makes one of the arteries of the dura mater, but it is a very delicate twig.

In general one artery only of the dura mater is known or mentioned; but here we have seen, besides the great artery of the dura mater, lesser arteries entering to it by all the perforations at the basis of the skull. The pharyngeal actually terminates in the dura mater, passing through the foramen lacerum posterius, and sending also a branch in together with the jugular vein. The occipital artery also sends one with the jugular vein, one by the foramen mastoideum, and one by a small hole in the occiput. The temporal often sends one through by the hole in the back part of the parietal bone.

5. ARTERIA OCCIPITALIS.

The occipital artery is also a simple artery, distributing its twigs about the ear, over the occiput, and

down the back of the neck, and having no branches of fufficient importance to be particularly marked.

It arifes next to the pharyngeal from the back part of the carotid; and lying particularly deep, it not only is covered at its root by the other branches of the carotid, but is covered in all its courfe by the thick mufcles of the neck, except juft where it is paffing round the maftoid procefs.

At firft the occipital artery lies clofe in among the bones, paffing over the tranfverfe procefs of the atlas, croffing the root of the great jugular vein, and paffing under the root of the maftoid procefs, fo as to lie at this place under the belly of the digaftric mufcle. Still as it encircles the occiput, it paffes along very deep under the bellies, firft of the trachelo-maftoideus, and then of the fplenius and complexus, and emerges only when it arrives at or near the middle ridge of the occiput; and laftly, it rifes with many beautiful branches over the back of the head, to meet the branches of the temporal artery.

In this courfe the occipital artery fends out the following branches:

1. Branches to the biventer, which lies over it, and to the ftylo-hyoideus mufcle; and there is one longer artery which attaches itfelf to the root of the maftoid mufcle, and paffes along that mufcle, to inofculate with the thyroid arteries, or with the lower cervical arteries, which mount upwards as this defcends.

2. Next it gives, like the pharyngeal, a fmall artery, which goes backwards along the jugular vein; and having entered by the foramen lacerum, attaches itfelf within the fkull to that part of the dura mater which lies under the lobes of the cerebellum.

3. The occipital artery, as it paffes under the ear, fends out to it a fmall pofterior artery, which goes to the little lobe of the ear, and creeps up along its pofterior border.

4. At this point the occipital often gives another artery, which paffes upwards behind the ear, and is named the POSTERIOR TEMPORAL ARTERY.

5. The occipital artery, as it paſſes under the trachelo-maſtoideus and ſplenius, gives branches to theſe two muſcles; and it ſends out from betwixt the trachelo-maſtoideus and complexus a long branch, which deſcends along the neck a conſiderable way; and after having further ſupplied the ſplenius, complexus, and alſo the deeper muſcles of the neck, it terminates by inoſculating with a branch from the axillary artery, which as it croſſes the neck is named tranſverſalis colli. This deſcending branch of the occipital inoſculates alſo with the vertebral arteries through the interſtices of the vertebræ.

Having pierced the belly of the complexus, the artery now riſes over the occiput in ſmall and beautiful arteries; the chief of which belong to the occipital belly of the occipito-frontalis muſcle and to the ſkin: it finally ends in inoſculations with the backmoſt branches of the temporal artery. But of theſe extreme twigs of the occipital, two are remarkable, becauſe they paſs through the ſkull to the dura mater; one through a ſmall hole in the occipital ſpine, and one through that ſmall hole which is behind the maſtoid proceſs. Sometimes the hole is in the temporal bone, but more frequently in the future which ſurrounds the back part of the temporal bone*.

6. ARTERIA POSTERIOR AURIS.

THE POSTERIOR ARTERY OF THE EAR is the ſmalleſt and leaſt conſtant of all the arteries which go off from the carotid; for it is often wanting, or often comes from ſome branch, and not from the carotid itſelf; often from the occipital, ſometimes from the pharyngeal artery; it can ſcarcely be reckoned as a regular branch of the carotid. This artery alſo, like the pharyngeal and occipital, gives out no diſtinguiſhed branches which we need to mark; it chiefly belongs to the ear, it gives branches to the cartilage of the external ear, it ſends

* Viz. the additamentum ſuturæ ſquamoſæ.

a larger

a larger branch through the ſtylo-maſtoid hole to the internal ear, and the reſt of its twigs go to the integuments, or to the bones.

The POSTERIOR AURIS ariſes much higher than any of thoſe arteries which have been juſt deſcribed; it does not come off from the external carotid till it reaches the parotid gland; or rather, it ariſes where the carotid is plunged into the ſubſtance of that gland; it paſſes directly acroſs under the ſtyloid proceſs, and over the belly of the digaſtric muſcle, and then goes up behind the ear: in this paſſage it gives branches to the parotid gland, and to the biventer muſcle, the parts on which it lies; next it gives a twig, which furniſhes the root of the cartilage of the ear, and perforates the loweſt part of the cartilage, ſo as to ſpread itſelf upon the drum of the ear; this branch is named ARTERIA TYMPANI.

Its next branch, the ARTERIA STYLO-MASTOIDEA, is the moſt remarkable, for it is of conſiderable ſize, enters the maſtoid hole, while the portio dura, or great nerve of the face, comes out: it is a chief artery of the internal ear; for it gives branches, 1. to the tympanum, one of which beautifully ſurrounds the bony circle, and then ſpreads upon the membrane itſelf; 2. to the muſcle of the ſtapes, to the ſemicircular canals, to the cells of the maſtoid proceſs and its delicate veſſels; which arteries, when well injected with ſize, paint the walls of the cavity of the tympanum, and of the ſemicircular canals.

The main artery having given off the arteria tympani and this ſtylo-maſtoid artery, and having paſſed the ſtylo-maſtoid hole, becomes properly the arteria poſterior auris, riſing behind the ear, and giving its branches to the ſkin and maſtoid muſcle, and to the muſcle behind the ear (poſterior auris), and to the bone and perioſteum, chiefly about the maſtoid proceſs; then its ſmall branches play round the back part of the concha or ſhell of the ear; and, laſtly, the artery, ſtill mounting behind the ear, ends in ſmall twigs, which go to the faſcia of the temporal muſcle, and which of courſe inoſculate above the ear with the temporal artery.

THIRD ORDER.

THE third order of arteries includes the termination of the external carotid artery in the temporal and maxillary arteries, which is after the following manner:

The artery having entered into the parotid gland, lies there abſolutely imbedded in its ſubſtance; and of the two arteries in which it terminates, one paſſes directly through the ſubſtance of the parotid gland, emerges before the ear, mounts upon the temple, and is named of courſe the TEMPORAL ARTERY; it performs here in the temple the ſame office which the occipital does behind, viz. it ſupplies the pericranium, muſcles, and ſkin: all this is very ſimple. But the other branch, in which (ſince it is exceedingly large) one would ſay the carotid terminates, goes off from the temporal with a ſudden bend, ſinks very deep under the articulation of the lower jaw, terminates in a laſh of branches at the back of the antrum Highmorianum, and there gives branches to the lower jaw, the upper jaw, the inſide of the cheeks, to the temple (deep arteries which lie under the temporal muſcle), to the upper part of the pharynx, to the noſtrils, and to various other parts; it is this artery too which gives off the chief artery of the dura mater. The deſcription of ſo great an artery, ſo widely diſtributed, becomes both difficult and important.

7. ARTERIA MAXILLARIS INTERNA.

THE INTERNAL MAXILLARY ARTERY turns off from the temporal artery while imbedded in the ſubſtance of the parotid gland, and about the middle of the upright branch or proceſs of the lower jaw-bone. It paſſes betwixt the lower jaw-bone and the outer pterygoid muſcle; it then goes forwards till it touches the back part of the antrum maxillare, and terminates in a laſh of veſſels betwixt the back of the antrum and the

the pterygoid procefs; and, finally, it ends at the fpheno-maxillary fiffure, or, in other terms, at the bottom of the focket of the eye, where it gives the infra-orbitary artery, and a branch to the back of the noftrils.

In all this courfe the internal maxillary artery is extremely tortuous: Firft, It rifes with a high and round turn at that point where it goes off from the temporal artery; then it bends fuddenly downwards, where it paffes betwixt the pterygoid mufcle and the jaw-bone; then, as it approaches the back of the antrum, it rifes with a third bending, and continues rifing with very great contortions, till it ends in a lafh of fmall veffels at the back of the eye and noftrils.

Before this artery gives out its greater branches, which require to be marked with numbers, it very generally gives fome fmall twigs, namelefs, and of lefs note; as a fmall twig to the ear, and the glands around it, another which gets into the tympanum to the mufcle of the malleus, and a branch of it fometimes goes into the fkull by that hole named foramen ovale, by which the fifth pair of nerves come out, and goes to that part of the dura mater which covers the fides of the fella turcica.

1. Of the larger branches which the internal maxillary gives out, the firft is the ARTERIA MENINGEA, the great or MIDDLE ARTERY of the DURA MATER. It goes off from the maxillary juft where it leaves the temporal artery. Sometimes before entering the fkull it gives fmall branches to the pterygoid mufcle, to the mouth of the Euftachian tube, to the os fphenoides, and fometimes through that bone to the dura mater; but the main artery paffes through what is called the fpinous hole, which is in the very extreme point or fpine of the fphenoid bone: it is this artery of which the furgeon fhould be particularly aware, and which touches the parietal bone at its loweft corner in the temple, and fpreads from that point all over the dura mater like the branches of a tree. But befides thefe, its chief branches, which fpread thus upon the parietal bone, on its inner

ſurface, it gives ſmaller ones, which go into the ſubſtance of the bone, or into the ear, and ſometimes through the orbit into the eye. Thus firſt ſeveral ſmaller twigs go into the ſubſtance of the os petroſum to nouriſh it; the holes may be ſeen about the rough part, where the os ſquamoſum and os petroſum are united; next two twigs enter into the aqueduct by the ſmall hole on the fore-part of the petrous bone, one keeping to the canal itſelf, the other going to the cavity of the tympanum, and to the inner muſcle of the malleus; and, laſtly, one or two ſmall twigs paſs through the outer end of the foramen lacerum into the orbit, and go to the lachrymal gland*.

2. The LOWER MAXILLAR ARTERY is a ſlender and curious artery, which belongs chiefly to the teeth of the lower jaw, and which runs all along in a canal within the jaw-bone. The internal maxillary proceeds nearly an inch before it gives off this branch; and then, while lying under the pterygoid muſcle, it gives off a long and ſlender artery, which enters the jaw-bone at that great hole which is betwixt the condyloid and coronary proceſſes; then runs all along within the jaw-bone, ſurrounding each of the teeth with arteries at the bottom of each ſocket. About the middle of the jaw-bone it divides into two branches, which proceed together in the bony canal, till one of them emerges upon the chin at the mental hole, inoſculating there with the arteries of the face, viz. the labial and ſubmental arteries, while the other goes onwards to ſupply the roots of the fore-teeth alſo, and to meet its fellow within the jaw-bone at the chin. The nerve for the lower jaw enters along with this artery; the vein of this artery accompanies it, but lies under it in a ſeparate canal, though ſtill in the ſame line. The artery itſelf, before it enters into the hole of the lower jaw, commonly gives twigs to the inner pterygoid muſcle which covers the hole. Conſi-

* Sometimes the great and proper artery of the lachrymal gland, inſtead of ariſing from the ophthalmic or proper artery of the eye, ariſes thus from the artery of the dura mater.

dering

dering the ſize of this artery, we cannot wonder at profuſe bleedings from the teeth, or rather from their ſockets.

3. THE PTERYGOID ARTERIES.—While the artery is thus croſſing betwixt the jaw and the pterygoid muſcle, it gives branches to the external pterygoid muſcle, both into its ſubſtance and over its ſurfaces. The number of theſe pterygoid arteries is variable and unimportant.

Next, while the maxillary artery is paſſing in a contorted form under the zygoma, where the temporal muſcle is lodged, it gives off two arteries, which are called the DEEP TEMPORAL ARTERIES, to diſtinguiſh them from the proper temporal artery, the only one which we feel outwardly, and which is ſuperficial. Of theſe two deep temporal arteries, one runs more outwards, viz. towards the ear, the other runs more inwards, viz. cloſer upon the bone; whence the one is called the DEEP EXTERNAL, the other the DEEP INTERNAL, TEMPORAL ARTERY.

4. THE DEEP EXTERNAL TEMPORAL ARTERY ariſes where the maxillary is paſſing under or near the jugum; it is of courſe near the coronary proceſs of the jawbone. This branch then paſſes along the tendon of the temporal muſcle, and ends in that muſcle, giving branches alſo to the external pterygoid muſcle; it is a ſhort artery, and not very important by its ſize.

5. The deep internal temporal artery ariſes farther forwards, viz. where the artery is cloſe upon the back of the antrum; from which point, mounting directly upwards, it paſſes in the very deepeſt part of the temporal arch, viz. that which is formed by the cheek-bone. It is longer and more important than the outward branch, ſupplies the deepeſt and thickeſt part of the temporal muſcle, mounts pretty high upon the temple betwixt the muſcle and the bone, and often, where it lies behind the cheek-bone, it ſends a branch through that bone into the orbit which ſupplies the fat and perioſteum of the ſocket, and in ſome degree alſo the lachrymal gland.

6. The ARTERY OF THE CHEEK is a very regular artery, in ſo far as regards its deſtination, viz. for the cheek; but in its origin it is extremely irregular. It has not often the importance of coming off as a diſtinct branch from the maxillary; but comes off rather more frequently from ſome of its branches, as from the deep temporal artery juſt deſcribed, or from the alveolar, or infra-orbital arteries, which are preſently to be deſcribed. This artery perforates the buccinator muſcle, and is ſpent upon it, and upon the other muſcles of the cheek, as the zygomaticus and levator labii; it ends, of courſe, by inoſculations with the arteries of the face.

7. The ARTERY OF THE UPPER JAW ſerves much the ſame office with that of the lower jaw, viz. ſupplying chiefly the ſockets of the teeth; whence it is named ARTERIA ALVEOLARIS. It is an artery fully as large as that of the lower jaw; it begins upon the back of the antrum Highmorianum, and runs round that tuberoſity towards the face and cheek with very tortuous branches. Its branches are diſtributed firſt to the buccinator and fat, which fills up the great hollow under the cheek-bone, and alſo to the cheek-bone itſelf, where it is connected with the jaw-bone. Secondly, Other branches perforate into the antrum Highmorianum by ſmall holes, which are eaſily ſeen upon its back part, and ſome of theſe branches go into the ſockets of the backmoſt teeth. Thirdly, A more important branch than any of theſe, the branch indeed from which it has its name of alveolar artery, enters by a hole into the ſubſtance of the jaw-bone, and goes round in the canal of the teeth juſt as the artery of the lower jaw does, giving branches to each ſocket. The curlings of this artery upon the back of the antrum are very curious; and while its deeper artery furniſhes the teeth, ſome of the ſuperficial branches go to the gums.

8. The INFRA-ORBITAL is ſo named from the hole or groove by which it paſſes all along under the eye from the back of the noſtril till it emerges upon the face. The infra-orbital, and the branch laſt deſcribed, viz. the alveolar artery, generally come off from the maxillary by one common trunk; the alveolar goes forwards and down-

downwards by the back of the antrum: the infra-orbital mounts upwards, and enters the ſpheno-maxillary hole, or rather it comes off juſt at the ſpheno-maxillary hole, which is the great ſlit at the bottom of the eye. As the artery enters its proper canal at the bottom of the eye, it gives ſome twigs to the perioſteum and to the fat of the ſocket; as it paſſes along its canal in the bone, one branch dives down into the antrum through the bone; for this plate of bone in which its groove runs, is at once the floor of the eye and the roof the antrum; within the ſocket it gives twigs alſo to the deprimens occuli, and to the lower oblique muſcle, to the lachrymal ſac, or even to the noſtrils; when it emerges from the ſocket by the infra-orbitary hole, it terminates in the levator labii and levator anguli oris, and in inoſculations with the arteria buccalis, labialis, and eſpecially with the naſal branch of the occular artery. This infra-orbitary artery is accompanied through the canal, and out upon the face, with a ſmall nerve of the ſame name, viz. the infra-orbitary nerve.

After this the maxillary, though nearly exhauſted, ſtill ſends out three ſmall arteries, in which it terminates irregularly, ſometimes one, ſometimes another twig being larger. Of theſe three, one goes to the palate, one to the pharynx, one to the noſtrils.

9. The UPPER PALATINE ARTERY ariſes near the infra-orbital; and from that point, viz. the ſpheno-maxillary ſlit, it deſcends along the groove, which is formed betwixt the pterygoid proceſs and the palate bone; and when it has got down to the palate, one leſſer branch turns backwards through the poſterior palatine hole, and expands upon the velum palati; the other larger branch is the great palatine artery, for it comes through the anterior or larger palatine hole; the artery itſelf is large, it runs all along the roof of the mouth betwixt the pulpy ſubſtance of the palate and the bone; in this progreſs it gives little arteries to the ſockets of the teeth, and it frequently terminates, not merely in the palate itſelf, but in a ſmall artery which runs up through the foramen inciſivum, or hole under the fore-teeth, into the cavity of the noſe

nofe. This artery is alfo accompanied with a correfponding palatine nerve.

10. The UPPER PHARYNGEAL ARTERY is the higheft of all the branches of the internal maxillary; it goes off at the back of the orbit, oppofite the fpheno-maxillary fiffure; it afcends along the fphenoid bone to the place of the fphenoidal finus, and along the upper part or arch of the pharynx, where that bag adheres to the bafis of the fkull; it alfo goes along the fides of the pharynx: its twigs are of very diminutive fize; fome go into the fubftance of the fphenoid bone to nourifh it by fmall holes both over the cells and in the alæ: a branch goes towards the ptery goidean or vidian hole*, where it inofculates ufually with a branch from the internal carotid artery, fometimes with the lower pharyngeal, or with the meningeal arteries.

This artery ends in fmall branches which play round the mouth of the Euftachian tube.

11. The NASAL ARTERY is the laft branch of the internal maxillary. It paffes through the fpheno-palatine hole †; by this opening it comes into the noftril at its upper and back part; the twigs go, one fhorter to the backmoft of the æthmoid cells, another to the cells of the fphenoid bone; one longer branch goes to the back part of the feptum narium; and one branch, the longeft of all, often paffes both the upper and lower fpongy bones (along the lining membrane of the nofe, giving twigs to the antrum as it paffes), till it inofculates with that twig of the palatine artery which rifes through the foramen incifivum into the nofe. This nafal artery often has two branches.

* This is the hole by which the recurrent of the 5th pair goes backwards from the nofe into the fkull.

† Obferve, this is not the fpheno-maxillary flit fo often mentioned; which is a flit-like opening lying between the wing of the fphenoid bone and the upper jaw-bone; and, as it is at the bottom of the focket, whatever parts enter it go to the eye. The fpheno-palatine hole is betwixt the fphenoid and palate bones; it is at the back of the noftrils, and the branch which enters it belongs to the noftril.

8. ARTERIA TEMPORALIS.

The TEMPORAL ARTERY, if we conſider its ſtraight direction, may be regarded as the termination of the external carotid artery. When the maxillary artery bends away from it to go under the jaw, this goes directly forwards through the ſubſtance of the parotid gland, mounts before the ear; and as it paſſes alternately the parotid gland, the face, the ear, it gives its three chief branches to theſe parts, and ends in that temporal artery which runs along the ſide of the head under the ſkin, which we feel, and even ſee diſtinctly, beating, and which we open when bleeding in the temples is required.

The temporal artery is named SUPERFICIAL, becauſe of its lying under the ſkin only, above the faſcia of the temporal muſcle, while the deep branches from the maxillary artery lie under the muſcle.—The temporal artery paſſes juſt before the meatus auditorius, and behind the branch of the jaw-bone; it puſhes its way through the ſubſtance of the parotid gland, and there it gives its firſt branches, commonly ſeven or eight in number, but quite irregular, into the ſubſtance of the gland itſelf; next it gives off to the face an artery of very conſiderable ſize; which ariſes from the ſame part of the artery with theſe parotideal branches, viz. under the zygoma and within the gland: like them it goes off almoſt at a right angle, and is like one of them, but larger, nearly of the ſize of a crow-quill; it puſhes ſidewiſe through the ſubſtance of the parotid, emerges from it upon the face juſt below the cheek-bone; runs acroſs the cheek in the ſame direction with the parotid duct; it is named from this direction TRANSVERSALIS FACIEI. Its branches go to the joint of the jaw-bone, the maſſeter, buccinator, parotid gland, &c. and terminate in inoſculations with all the arteries of the face.

Next the temporal artery, as it riſes towards the zygoma, and of courſe approaches the angle of the jaw, gives an artery which is proper to the articulation of the jaw. This artery belonging to the joint of the jaw is often named ARTERIA ARTICULARIS. After

 having

having ſent its two branches to the articulation of the jaw, it ſends another artery to the ear, which divides into two twigs; one of them going round the back part of the ear, aſſiſts the branch of the ſtylo-maſtoid artery in forming the little circular artery of the tympanum; while another branch, penetrating through the ſlit which is in the articulation of the lower jaw, goes to the muſcle of the malleus.

But before it reaches the zygoma, the temporal artery gives another branch, which is named the MIDDLE TEMPORAL ARTERY, to diſtinguiſh it from the deep temporal arteries which lie under the whole thickneſs of the temporal muſcles, and the ſuperficial temporal, which lies above the faſcia; for this middle temporal artery lies under the faſcia: but on the outſide of the muſcle it ariſes from the main artery juſt under the zygoma, riſes over the zygoma, and then pierces its way under the faſcia of the temporal muſcle, and under that covering gives branches to the temporal muſcle, the artery itſelf ſtill riſing and paſſing obliquely forwards towards the outer corner of the eye, where one of its twigs often goes to the orbicularis oculi, and inoſculates with the ophthalmic artery.

About this point, or rather above the zygoma, the temporal gives off thoſe ſmall arteries, irregular in number, which are named ANTERIORES AURIS, the anterior arteries of the ear, and which play all round the fore-part of the ear.

The temporal artery having now emerged from the parotid gland, and from the thick faſcia which covers it, makes a ſudden ſerpentine turn before the ear; and then riſing about half an inch perpendicularly, it forks with a pretty wide angle into two arteries, which are named the anterior and poſterior temporal arteries. Theſe lie quite ſuperficial under the ſkin, above the faſcia, and are diſtributed in this manner; Firſt, the ANTERIOR TEMPORAL ARTERY goes directly forwards to the naked part of the temple, runs up the ſide of the forehead with a very ſerpentine courſe; it is here that in old men we ſee its contortions and pulſation very diſ-

tinctly;

tinctly; it goes round arching forwards, and upwards from the temple towards the top of the head. It belongs chiefly to the skin and frontal muscle, and that tendinous kind of sheath which covers the cranium; it gives some branches to the orbicular and corrugator muscles; it forms often a superciliary arch with the proper frontal artery; it often sends off a branch very early towards the outer corner of the eye, which is entirely destined for the orbicularis oculi.

The POSTERIOR TEMPORAL ARTERY is the last branch of all. It arches backwards over the top of the ear; it turns thus backwards till it meets the branches of the occipital artery; it deals its branches from either side upwards and downwards, i. e. towards the ear, and towards the top of the head in great profusion, till it is quite exhausted. These branches belong to the skin chiefly and to the pericranium; and the smaller twigs pierce the outer tables of the skull, and go into the bone in great profusion for its nourishment.

CONCLUSION.

IT would surely be wrong to conclude the description of a system of arteries so important as this, without attempting to interest my reader in this piece of anatomy, by observing a few anatomical and surgical facts.

That arteries are not tortuous to favour the extension of parts, but rather because they have been extended and long pushed by the current of blood, is a fact very manifest to any one who considers the condition of many of these arteries which I have just described. When we first observe the thyroid, lingual, and labial arteries; when we consider that the tongue, the throat, the lips, are moveable and dilatable parts—we are apt to say that such arteries are tortuous to favour those motions. But when we remark the curling form of the alveolar artery, where it lies against the back of the antrum; of the occipital artery, where it lies firm against the bone; of the temporal, where it rises along the side of the head

head—we perceive clearly that this curling has nothing to do with dilatation. And Dr. Hunter's obſervation of the arteries of the womb being tortuous, to allow of extenſion, is not like the obſervation of ſo great an anatomiſt, but of one who had not conſidered many of the chief arteries in the body: For the womb itſelf has its arteries more tortuous at the end of pregnancy than at its commencement; and the ſtomach, the bowels, the bladder, although they ſuffer greater and more ſudden diſtenſion than the womb, have arteries which are very ſtraight in their courſe. Are there any curling arteries in the muſcles which contract to one half their diameter? are there any in the joints which twiſt and bend ſo freely? are there any curling arteries in the whole ſyſtem of a child? are there any arteries in the whole ſyſtem of an aged perſon which want this tortuous form? In ſhort, this tortuous form has no relation to the dilatation of the parts: it is merely a conſequence of the long continued preſſure of the blood: it is this only that can account for the ſlowly increaſing tortuoſity in the temples or hands of an old man, or the ſudden tortuoſity which the newly dilated artery aſſumes after the operation for aneuriſm.

Next it is natural to obſerve, as a thing which may prevent confuſion in the ſtudent's mind, how irregular (after all our attempts at arrangement) the ſmaller arteries unavoidably muſt be; how natural it is that each particular part ſhould draw its blood from all the arteries which are near or round it. The ear has its poſterior artery peculiar to itſelf; but it has alſo an anterior artery from the temporal, where it lies under the parotid gland; and it has even a ſuperior auris from that branch of the temporal artery, which bends round towards the occiput, and arches over the ear. The dura mater has its great middle artery appropriated to itſelf; a peculiar branch, the firſt of the maxillary artery; but it has beſides ſmall aſſiſting arteries, entering by almoſt every point at the baſis of the ſkull; and eſpecially it has arteries from the maxillary, by the mouth of the Euſtachian tube, from the pharyngeal, running in by

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the hole for the great jugular vein; and from the occipital both by the hole of the jugular vein in the basis of the skull, and also by the small occipital hole in the back part of the skull, close by the temporal bone. The throat also, though it has many peculiar arteries, derives its branches from a great many sources; as from the lingual artery by twigs, which cross the root of the tongue; from the labial artery by branches, which go to the tonsil, tongue, and palate; from the pharyngeal artery, many branches not confining themselves to the pharynx, stretch forwards to the palate, tongue, and tonsils; and, lastly, the maxillary artery gives a profusion of branches to all parts of the throat. These may serve as hints by which the student, if he wishes to become a correct anatomist, may trace the inosculations; or for the surgeon, if he wishes to separate the study of this minute anatomy from that of the greater arteries.

The surgeon's interest in understanding these arteries is, indeed, very strong. It were impossible to enumerate all the various occasions on which this piece of anatomy may be useful; but, surely, one may easily say enough on this subject to attach the young surgeon to the diligent study of these arteries.

Among the various motives for diligence, I would mention these; the terrible hæmorrhagies which he is daily called to stop, when suicides, though they have not cut the carotids, have cut the great arteries of the thyroid gland; the necessity of thinking about the tumours of the gland itself, for I have had the unhappiness to see a person perish by suffocation while consulting physicians forbade any operation; and I had no other than the melancholy privilege of watching, for many hours, the last struggles of a person, who had the day before been walking through all the rooms in tolerable ease and health. Could nothing have been resolved on? Must we always submit to this? Might not an incision in the fore part (where few arteries are) have at least uncovered the trachea, given a temporary relief, and made the tumor suppurate more freely? The extirpation

extirpation of the tongue, which is mentioned with horror, would be a leſs terrible operation to one acquainted with theſe arteries; the extirpation of all tumours under the jaws is dangerous; the cutting out completely the parotid gland is a thing quite impoſſible, ſince the greateſt of all the arteries, viz. the temporal and the maxillary, lie abſolutely imbedded in the gland. What ſhall we think, then, of thoſe ſurgeons who talk in ſuch familiar terms of cutting out the parotid gland? Bleedings from the noſe have been ſo often fatal, that Petit is celebrated to this day for a diſcovery which he never made, viz. the way of plugging the noſe ſo as to ſtop this bleeding. Have not the French Society been buſy renewing inventions for ſecuring even ſo ſmall an artery as that of the dura mater? In the hair-lip operation, in cutting cancers, in diſſecting tumours from all parts of the face, the ſurgeon commands the blood only by knowing theſe arteries. Cowper, the celebrated ſurgeon and anatomiſt, had his head ſo full of this project, that inſtead of waiting for hæmorrhage during his operation, he cut off two days before the chief ſource of the blood. He was going to cut out the parotid gland; and two days before he placed a ſmall button of cauſtic on each ſide of the labial artery, where it lies upon the cheek, paſſed a ligature under it, tied it firm, and then proceeded to his operation next day. But this great anatomiſt made at one ſtroke two grievous blunders: he miſſed, for want of knowledge, the chief arteries of the parotid gland, for they come from the temporal artery; and, if I miſtake not, he had tied the vein, for moſt aſſuredly it is the faſcial vein which he is deſcribing in his twelfth table from Bidloo. How terrible the extirpation of tumours from the gums, throat, tonſils, &c. I need not ſay; where the ſurgeon always uſes burning irons inſtead of needles, where not unfrequently the patient dies.

SECT.

SECT. II.

OF THE ARTERIES OF THE BRAIN, SPINAL MARROW, AND EYE.

§ 1. OF THE ARTERIES OF THE BRAIN.

THE INTERNAL CAROTID ARTERIES are named the ARTERIÆ CEREBRI, as being the chief arteries of the brain; while, in truth, the brain is alſo ſupplied by two other arteries nearly equal in ſize, viz. the vertebral arteries, which, though they do indeed ariſe from a different trunk, viz. the ſubclavian artery, yet are ſo entirely deſtined for the brain, give ſo few branches before they reach the ſkull, are ſo important when they arrive there, and above all make ſo large a communication with the carotid arteries, that without a deſcription of the vertebral arteries, any deſcription of the carotids muſt be defective; they unite ſo with the carotids as to form but one great ſyſtem of veſſels for ſupplying the brain.

The two greateſt functions of the animal body, thoſe of the womb and of the brain, the one for the life of the individual, the other for the continuation of the ſpecies, are the moſt liberally ſupplied with blood. The womb has on each ſide two arteries; it has two ſpermatics, and two hypogaſtrics, and the inoſculations of theſe veſſels are very large and free. The brain has two great arteries on each ſide; it has two carotids, and two vertebral arteries; they are infinitely larger than thoſe of the womb; their inoſculations are ſo particular, that there are no others like them in all the body: the injection of any one artery eaſily fills the whole; the preſervation of but one artery ſaves the life of the creature, when the others are ſtopped.

Theſe four arteries alone convey to the head the fifth part of the whole maſs of blood. This is the calculation of the older authors; and even thoſe who would ſettle

ſettle it at the loweſt point ſtill acknowledge, that the carotid and vertebral arteries receive at leaſt the tenth part of all the blood of the body. The brain then which weighs not a fortieth part of the whole body, receives one-tenth of all the blood; a proportion which muſt occaſion ſurpriſe.

Beſides the profuſion of blood which thus ruſhes into the brain, the impetus with which it forces its way ſeems dangerous; and Nature alſo ſeems to have provided againſt the danger. We cannot be but ſenſible of this danger; for the ſlighteſt increaſe of velocity occaſions ſtrange feelings, if not abſolute pain. We cannot run for any length of way, nor aſcend a ſtair rapidly, nor ſuffer a paroxyſm of fever, nor in ſhort have the circulation quickened by violent exertions, by emotions of the mind, or by diſeaſe, without feeling an alarming beating within the head; we feel it particularly in the carotid canal where the artery paſſes through the bone. If it continue from diſeaſe, or if we perſiſt in our exertions, giddineſs, blindneſs, ringing of the ears, come on. Haller remembers, that while he was lying in a bad fever, he ſuffered ſo much from the pulſations of the carotid artery within the ſkull, that his head was lifted from his pillow at every ſtroke. I wiſh he had ſaid, "ſeemed to be lifted from his pillow at every ſtroke;" for it was rather a ſickly feeling than what could actually happen.

Did this vaſt column of blood ruſh directly into the brain, we do not know what might be its effects; but ſurely they could not be harmleſs, ſince Nature has provided againſt it in man, and in the lower animals which hang their heads, with a peculiar care. In Man, this blood is retarded chiefly by the tortuous courſe which the artery is obliged to follow, and by that long bony canal which, by holding the carotid as in a ſheath, muſt ſuppreſs its violent action, and at leaſt prevent its being dilated by force of the blood, when, as often happens, the lower part of the artery is more full and tenſe. Perhaps alſo it may have ſome effect, that the carotid, as it lies by the ſide of the ſella turcica, is not naked

naked and free, but is inclosed in a venous sinus, which consists of cells like those of the male penis, and in the heart of which the carotid lies bathed in the blood.

It is also peculiar in all the arteries of the brain, that they do not enter in trunks into its substance. This seems to be a violence which the soft texture of the brain could not bear; but all the arteries having perforated the dura mater, attach themselves to the pia mater, a delicate membrane, which is the immediate covering of the brain; which follows all its divisions, lobes, and convolutions; which enters all its cavities, and lines its internal surfaces as it covers the external. To this membrane of the brain the arteries attach themselves: it conducts them every where along the surface of the brain, and into its cavities; and when the arteries are to enter into the substance of the brain, they have already branched so minutely upon the pia mater, that they enter into the pulpy substance in the most delicate twigs; so that having injected the brain, at whatever level you cut into it, you find its white surface dotted with red points regularly, and like the dots of a pin.

But in the lower animals, especially in the Calf, the Deer, the Sheep, which hang their heads in feeding, there is a provision of so singular a nature, that we can have no doubt that these contortions of the great trunks and minute divisions of the smaller arteries in Man have the same final cause; for in those creatures the carotid, before it enters the brain, first divides into innumerable smaller arteries. Not one of these is sent off for any particular function: they are immediately reunited again, and gathered together into one trunk; and then the force of the blood being thus broken, the artery divides a second time into branches of the ordinary form, which enter safely into the substance of the brain.

It is still further supposed, that the arteries of the brain have this peculiarity, distinct from all others in the body, that as they enter the skull they lay aside one of their coats, and that of course the arteries of the brain are peculiarly weak. That the arteries of the brain want that outward coat of cellular substance which all arteries

passing

paſſing through other cavities or along the limbs have, is no doubt true, and ſo far they are thinner: but how much they are weakened by this loſs, it is not eaſy to ſay; for they want none of the coats which are eſſential to the conſtitution of an artery; and this cellular coat, though it conſtitutes much of the thickneſs of an artery, has, I believe, but little to do with its ſtrength. Yet true it is, that the arteries of the brain, either from being weaker in themſelves, being leſs ſupported, lying upon the ſoft and pulpy ſubſtance of the brain, are more frequently burſt by falls, or even by the ſlighteſt accidents, than the arteries of any other part, even the limbs, however much expoſed. Our injections burſt them very often; the ſlighteſt blow or fall upon the head often produces an internal effuſion of blood, which occaſions death; but that the arteries of the brain are ſo delicate as to be burſt by a falſe ſtep, ſo as to produce a fatal aneuriſm within the brain, is a truth perhaps not commonly known.

A young woman, carrying in her arms her firſt child, about ſix months old, ſlipped her foot with a ſlight ſhock; but it was on plain and even ground, and ſhe did not fall down. In the inſtant of this ſhock ſhe was ſenſible of a ſudden pain in the right ſide of her head: it was ſo peculiar, that ſhe ſaid ſhe could cover the point with her finger; and though ſlighter at intervals, this pain never left her to the moment of her death. She walked home, went about her little family-matters, ſuckled her child; but was ſeized that evening with ſickneſs, not violent like that of any ſudden diſeaſe, but rather like the eaſy vomiting of a pregnant woman.

She continued very ſick, with ſlight head-ach; but ſtill was out of bed all day long, went about her houſehold affairs, and had no ſymptom which could lead one to ſuſpect her very dangerous condition, or what a dreadful accident had happened. She got up during the night after this accident for ſome cool drink, felt herſelf extremely giddy, was obliged to ſupport herſelf by a cheſt of drawers which ſtood by her bedſide, and went to bed again immediately. On the evening of the ſecond day ſhe

ſhe got out of bed, made tea as uſual, was out of bed during the evening, had no complaint, except the continual ſickneſs, ſlight pain of the head, and giddineſs ſtill ſlighter. That night ſhe expired. Her pulſe all along had beat low and weak, and never more than 60 in the minute.

When I was brought to open the body, I heard nothing of the pain of her head, though it was fixed and conſtant, and without that nothing could be more puzzling than this combination of circumſtances. Firſt, the ſudden ſlipping of her foot, and the inceſſant ſickneſs which enſued, ſuggeſted the idea of hernia; but no ſuch ſecret was known among her relations; and upon opening the abdomen, no hernia was found, neither open nor concealed, as in the thyroid hole.

Next we were informed of a palpitation, which had been uſual with her. It appeared that ſhe had complained chiefly about the period of her firſt menſtruation, and ſome years before her marriage. It ſeemed to be hyſterical merely; but upon opening the thorax, we found the heart wonderfully enlarged and crammed with a dark and grumous blood.

But next a new ſcene opened upon us; and this enlargement of the heart appeared to ariſe like that of the liver, which ſo often accompanies fractured ſkull, from the languid action of the heart and torpor of all the ſyſtem in thoſe who lie even for a few days comatoſe.

Now, for the firſt time, I was informed that the ſhock of ſlipping her foot had cauſed a ſudden pain of the head; that it was pointed, confined to one ſingle ſpot, inceſſant, accompanied with perpetual vomiting or deſire to vomit, and with giddineſs during the night.

Upon opening the head, I found the dura mater of a moſt ſingular appearance; livid, or rather like the gizzard of a fowl, with green and changing colours. Having cut it open the pia mater appeared like red currant jelly, with freſh coagulated blood ſo firmly attached to it, that it ſeemed as if driven into its very ſubſtance and incorporated with it. Upon cutting and tearing open the

the pia mater, each convolution of the brain was surrounded and ſeparated from that next it by coagulated blood. Upon cutting into the ventricles of the brain, that of the right ſide was found to contain four ounces of entire and coagulated blood; the cavity at firſt view was like opening a ventricle of the heart; the blood, very dark and firmly coagulated, was forced out by the preſſure of the ſurrounding parts; the coagulum became gradually firmer and whiter, till it turned to a very firm ſtringy clot, which ſtuck in the mouth of the middle artery of the brain. Being carefully examined, it was found to be ſticking firm in the mouth of the artery which had burſt, as if by the ſeparation of two of its rings. The blood, which thus filled the right ventricle, had alſo made its way down in prodigious quantity into the third and fourth ventricles, quite into the occipital hole; but the oppoſite ventricle it had not filled.

The quantity of blood aſcending to the head is exceedingly great; its free circulation in all the arteries is perfectly ſecured; and the plan of its diſtribution is extremely ſimple, for the carotid entering by the os petroſum gives three branches. Firſt, A branch which unites the two carotids with the two vertebrals, and forms the fore part of the circle of Willis. Secondly, It gives an artery to the great middle lobe, whence it is named the great middle artery of the brain. Thirdly, An artery which is named anterior cerebri, as belonging to the fore part of the brain. But the vertebral, as it ariſes through the occipital hole, lies upon the cerebellum, and ſupplies all the cerebellum, and alſo the back part of the brain. One branch goes to the back part of the cerebellum, another to the fore part of the cerebellum, a third branch goes to the back part of the brain; and thus there is formed betwixt the carotid and the vertebral, by means of the great inoſculation of the circle of Willis, one great ſet of veſſels: which ſhould firſt of all be deſcribed free from all the interruptions of trivial arteries, which go off from point to point, but of which the

the deſtinations cannot be important, which are hardly known, which do not go in any two ſubjects the ſame way.

OF THE INTERNAL CAROTID ARTERY.

The internal carotid artery leaves the external carotid at the angle of the jaw: it is ſo inclined to contortions, that at this point it even bulges, and ſeems the outermoſt of the two. In mounting along the neck, it is tied by cellular ſubſtance to the fore part of the rectus or ſtraight muſcle of the neck, and it is alſo connected with the par vagum and intercoſtal nerve; the ganglion of the intercoſtal, or ſympathetic nerve, lies by its ſide; the nerve, before it forms this ganglion, comes down ſmall and thread-like through the ſame canal by which the carotid paſſes into the ſkull.

The contortions of the carotid are great, both before and after its paſſage through the bony canal; but within the canal it is forced to particular and ſucceſſive bendings, ſuch as indicate plainly ſome deſign of Nature; for the canal for the artery is long and tortuous, while the nerves and veins paſs through plain and ſimple holes. When the carotid firſt preſents itſelf to enter the ſkull, it is curved, and is a little behind its hole; it bends forwards and inwards a little, and ſo enters the canal; in entering the canal it riſes almoſt perpendicularly upwards, but ſoon bends forwards again, lying, as it were, upon the floor of the canal; then it bends again upwards and forwards, to emerge from the canal; by which turn the portion of the artery which is engaged in the canal has the form of an Italic *ſ*. Even after it gets into the ſkull, it muſt ſtill bend once more ſidewiſe and forwards, as if to meet its fellow, and to get to the ſide of the ſella turcica; then it goes directly forwards till it touches the anterior clynoid proceſs; and then doubling back, or returning upon itſelf, it riſes perpendicularly; and ſo perpendicular is this laſt turn, that when cut acroſs, the

mouth of the artery gapes perpendicularly upwards: here it begins to give its branches to the brain.

It is by the ſide of the ſella turcica that the CAVERNOUS SINUS ſurrounds the artery. This ſinus is formed by the two plates or lamellæ of the dura mater, parting from each other, and leaving an interſtice full of cells, like thoſe of the penis or of the placenta. It is filled with blood, by communication with ſeveral of the ſmaller ſinuſes or veins about the baſis of the brain; the ophthalmic veins bring into it the blood from the eye; four or five ſmall veins deſcending from the foſſa Sylvii bring blood into it from the middle parts of the brain; the ſinuſes of the os petroſum (both on its upper and lower grooves) open into it, one high, another lower down, and that circular ſinus or vein which ſurrounds the root of the optic nerves opens into it from either ſide. All this blood is poured into the cells, bathes the carotid artery which lies naked in it; and by the ſide of the carotid artery lies alſo that ſmall nerve of the ſixth pair which begins the great intercoſtal nerve, naked in the blood.

Veuſſens firſt diſcovered this curious ſtructure; Ridley denied it, and Haller at laſt in his turn confirmed it. Veuſſens believed that the ſinus which depoſited this blood conveyed it away again. Haller ſays that this is the peculiar office of that vein which accompanies the carotid artery, and which is named the vena ſodalis arteriæ carotidis. It was once ſuppoſed that certain ſmall arteries opened alſo into the ſinus; but it has neither arteries, nor pulſation.

Thus we trace the carotid through its canal, through the cavernous ſinus, up to the ſide of the ſella turcica, and about to enter the brain, to give off the arteries of the brain. But before we deſcribe theſe, it will be eaſy to count ſhortly thoſe little twigs which it gives off in the canal and in the ſinus.

The carotid artery ſeldom gives out arteries before it enters the ſkull; it is a luſus naturæ, when it does happen that the occipital or pharyngeal arteries come off from it.

The

The firſt twig, which in any caſe it gives off, is ſometimes a ſmall artery, which returns downwards along with the upper maxillary nerve *; next a ſmall twig, accompanied by a branch from the meningeal artery, goes into the tympanum by way of the aquæductus Fallopii; and next, while the artery is within the ſinus cavernoſus, it gives out two little branches, the one forwards, the other backwards, named ARTERIES of the RECEPTACULUM.

1. The little artery which goes backwards from the ſinus or receptaculum goes chiefly to that part of the dura mater which covers the poſterior clynoid proceſs, and which covers the cuneiform proceſs of the occipital bone; it gives twigs to the 4th, 5th, and 6th pair of nerves and to the pituitary gland; in ſhort, to all the parts at the back of the ſella turcica; it ends in inoſculations with thoſe twigs of the vertebral artery, which come off from the vertebral before it enters the ſkull.

2. The little artery which comes out from the receptaculum to go forwards, ariſes where the carotid is croſſed by the 6th pair, and has been miſtaken for a nerve by thoſe who ſuppoſe that the intercoſtal ariſes from a branch of the 5th pair. The diſtribution of this little artery is nearly the ſame with that of the firſt, for it belongs to the 3d, 4th, and 5th pairs of nerves and to the pituitary gland.

The carotid having riſen to the anterior clynoid proceſs, gives out there a ſmall artery, no bigger than a crow-quill, which enters directly into the orbitary hole, accompanies the optic nerve into the eye, furniſhes the eye, the eyelids, the muſcles, and the lachrymal gland, and ſends out branches upon the forehead, viz. the frontal arteries in which it ends. This is a ſhort hiſtory of the OPHTHALMIC ARTERY; which, as it furniſhes all the arteries of the eye, muſt be deſcribed apart.

* The ſecond branch of the 5th pair.

DIVISION OF THE INTERNAL CAROTID.

THE carotid, now about to enter into the brain, divides at the ſella turcica into three arteries; one to the fore lobe, another to the middle lobe, and a third to form the circle of Willis. Theſe arteries are uſually ſo numbered that the communicating branch is firſt deſcribed, next the anterior artery of the brain, and laſtly the middle artery of the brain. But of this arrangement no one who is accuſtomed to obſerve the courſe of this artery can entirely approve; for when the carotid riſes from the ſide of the ſella turcica, it divides into its three branches all at once, in a tripodlike form: the middle branch of the tripod is largeſt; the next, which goes forwards to the fore lobe of the brain, is ſmaller; the third, which is the communicating branch, going backwards to unite with the vertebral artery and form the circle of Willis, is the ſmalleſt of all. The middle artery of the brain then is, from its great ſize, to be regarded as the trunk.

I. ARTERIA MEDIA CEREBRI.

THE middle lobe of the brain is ſeparated from the anterior lobe by a very deep ſulcus or furrow, which is named FISSURA SYLVII. This fiſſura Sylvii is formed by the tranſverſe proceſs of the ſphenoid bone, or, in other words, by that very ſharp line which runs out laterally from each of the anterior clynoid proceſſes, and which parts the fore lobe, which lies in the ſhallow part of the ſkull upon the orbitary proceſſes of the frontal bone, from the middle lobe, which lies in the deepeſt part of the ſkull behind the clynoid proceſſes. The MIDDLE ARTERY OF THE BRAIN having riſen from the ſide of the ſella turcica, runs ſtraight along this foſſa Sylvii, and is really the continued trunk of the carotid; it is larger than the artery at the wriſt; it goes directly outwards, viz. towards the temple; it runs along the foſſa Sylvii, and is lodged deep in that cleft; where it lies deep, it divides into two great branches, one deep and one ſuperficial:

perficial: it gives fome branches to the anterior lobe, but it is chiefly limited to the middle lobe of the brain; its branches to the pofterior lobe, or inofculations with any branches of the bafilar artery, are comparatively few.

Thus the artery ends by paffing into the fubftance of the brain. But nearer the fella turcica, and before it enters into the foffa Sylvii, it gives fome fmall and delicate arteries; the confideration of which feems to be unimportant at firft view, but which is really ufeful in explaining the anatomy of the brain. It gives fmall twigs to the pituitary gland, to the optic nerve, to the tentorium, and efpecially to the pia mater covering the bafis of the brain. Among thefe fmall twigs certain fets of arteries make a very diftinguifhed figure.

1. There is one fmall artery which runs up into the anterior horn of the lateral ventricle, and forms that great plexus which lies along the floor of the ventricle, named PLEXUS CHOROIDES. This, then, is the ARTERY of the CHOROID PLEXUS.

2. There is a fet of arteries, of confiderable number, but varying in refpect of number, fmall as fewing threads, which inofculate repeatedly with each other, and which are fcattered widely and beautifully over the crura cerebri and bafis of the brain, forming in the pia mater a plexus or web of veffels. This part of the pia mater is named velum from its beauty and delicacy; and this is what Wepfer, among other older authors, confidered as a fpecies at leaft of the rete mirabile: but that name implies a peculiar office, as in beafts, which this delicate net-work of veffels cannot have.

2. ARTERIA ANTERIOR CEREBRI.

THE FORE ARTERY of the BRAIN comes off from the middle artery at right angles nearly; for the great or middle artery runs directly outwards towards the temple, while this fecond artery runs directly forwards along the fore lobe of the brain. It is named fometimes the artery of the corpus callofum, becaufe that of two great branches into which it is divided one goes to that

part of the brain. The corpus callosum (a most absurd name for any part of the brain) is the white and medullary substance where the two hemispheres of the brain are joined; and upon separating the two hemispheres with the fingers, the corpus callosum is seen like a large white arch, and the artery of the corpus callosum is seen also arching over its surface.

The anatomy of the arteria anterior cerebri may therefore be explained thus: First it goes off at right angles from the middle artery of the brain, which is to be considered as the trunk, and there it often gives small twigs to the olfactory and optic nerves: next the two anterior arteries of each side, while they go forwards as if towards the crista galli, bend a little towards each other; they almost meet, but do not absolutely touch; they form a communication with each other, which of course is exceedingly short, but pretty large. It is this short communication which completes the circle of Willis at its fore part. This cross communication betwixt the arteries of the opposite sides passes just before the sella turcica and pituitary gland, and exactly in the middle it sends off an artery, which goes down into the third ventricle, and gives branches to the fore part of the fornix and to the septum lucidum.

After this communication, both arteries rise, with a large sweep along the flat surface of that deep division which the falx makes betwixt the two hemispheres of the brain; there each divides into its two great branches; one attaches itself to the corpus callosum, or that arch which we see upon holding apart the two hemispheres; it arches along with the corpus callosum so as to describe a semicircle; it is the larger of the two branches; it is named ARTERIA CORPORIS CALLOSI: the other branch keeps upon the flat surface of the brain, where the one hemisphere lies flat upon the other, and it rises in a beautiful arch within the pia mater, dividing into beautiful and very minute ramifications before it enters actually into the substance of the brain.

These two great branches of the anterior artery are well distinguished by Wepfer by the names of arteria profunda

profunda and arteria ſublimis (the deep and ſuperficial of the anterior artery), as there is a deep and a ſuperficial branch of the middle artery. The arch of the arteria anterior cerebri overhangs in a manner that of the artery of the corpus calloſum, and both of them inoſculate under the falx with the arteries of the oppoſite ſide.

3. ARTERIA COMMUNICANS.

THE COMMUNICATING ARTERY goes as directly backwards from the middle artery as the anterior artery goes forwards. It is ſmall, proceeds backwards, and a little inwards; it goes round the ſides of the corpora mamillaria, and is about a quarter of an inch in length before it meets the vertebral artery; and though it does give off ſmall twigs, as to the infundibulum, to the optic nerve, to the crura cerebri, and eſpecially one of greater ſize, to the choroid plexus; yet all theſe are trivial arteries, ſuch as every trunk at the baſis of the brain gives off. It is not its twigs that are to be obſerved, but itſelf only that is important, as forming one of the largeſt and moſt important inoſculations of the body. It unites the middle artery of the brain, which is the trunk of the carotid, with the poſterior artery of the brain, which is the firſt and greateſt branch of the vertebral artery.

This anaſtomoſis is the circle of Willis, too remarkable not to have been very long obſerved; it was drawn by Veſlingius and by Caſſerius; it is but ill repreſented by Bidloo and by Cowper; it is not a circle, but is right lined, and of courſe angular: it is of very unequal ſize; in one body it is large, in another ſmaller, often even in the ſame body; it is irregular, the one ſide being large and the other ſmall.

This inoſculation brings us round to the firſt branch of the vertebral arteries, viz. the ARTERIA POSTERIOR CEREBRI; for the vertebral artery gives two arteries to the cerebellum, and one to the back part of the brain.

OF

OF THE VERTEBRAL ARTERY.

THE vertebral artery, though but the ſecondary artery of the head, is a principal one of the brain, and conveys a very great proportion of blood; and its turnings and windings before it enters the ſkull are almoſt as particular as thoſe of the carotid itſelf. The vertebral is among the firſt branches of the ſubclavian artery, and comes off from it where it lies acroſs the root of the neck. The two lower ganglions of the ſympathetic nerve lie over it, and their threads ſurround its trunk, making curious net-works round it. The artery then enters into the canal prepared for it in the tranſverſe proceſſes of the vertebra, commonly getting in by the 6th vertebra: but in this it is irregular, ſometimes entering into the 7th or loweſt; and it has been ſeen entering into the uppermoſt hole but one. In this canal it aſcends in a direct line from the bottom of the neck to the top; but like the carotid it makes great contortions before it enters the ſkull; for when it has reached the ſecond vertebra, its tranſverſe proceſs being rather longer than thoſe of the lower vertebræ, the artery is forced to incline outwards; and the tranſverſe proceſs of the atlas or firſt vertebra being ſtill much longer, the artery in paſſing through it is carried ſtill farther outwards; it is forced to make a very ſudden turn, and is viſible without cutting the bones. When the artery has paſſed through the tranſverſe proceſs of the atlas, it makes another very ſudden turn, lies flat upon the circle of that vertebra, ſo as to make a large hollowneſs or groove upon the bone, and then it enters the foramen magnum by riſing in a perpendicular direction; and then again it bends and inclines forwards, laying flat along the cuneiform proceſs of the occipital bone, where it ſoon meets its fellow, and the two uniting form the baſilar artery.

This baſilar artery lies, with regard to the bone, upon the cuneiform proceſs of the os occipitis, and runs along it from the foramen magnum to the ſella turcica: with regard to the brain, it lies upon that great tubercle which

which is named the tuber annulare or pons Varolii; and as the artery goes along in one great trunk, it gives out from each ſide little arteries, which belong to this tuber annulare.

The brain has three arteries derived from the vertebral artery as it has from the internal carotid; two are given to the cerebellum and one to the cerebrum.

I. ARTERIA CEREBELLI POSTERIOR.

THE POSTERIOR ARTERY, OR LOWER ARTERY of the CEREBELLUM, is ſmall and not regular. It comes off from the baſilar artery either immediately after the union of the vertebrals, or from the vertebral artery immediately before the union. It is often ſmaller on one ſide than on the other, and ſometimes it is wanting on one ſide. It moves downwards in a ſort of retrograde courſe betwixt the acceſſory nerve of Willis and the group of fibres which form the eighth pair, and dives in betwixt the cerebellum and the medulla oblongata. Its larger branches ſpread out upon the pia mater, and then enter into the medullary ſubſtance. They belong to the cerebellum, to the ſpinal marrow, and ſome of them to the pons Varolii. But there are alſo ſmaller and particular twigs, as twigs to the eighth and ninth pairs of nerves: one alſo which enters into the fourth ventricle, to form a ſort of velum or choroid plexus there: and as this poſterior artery winds downwards under the cerebellum, it gives many branches about the vermis, and ſmall twigs which run betwixt the lower point of the pons Varolii and the pyramidal bodies.

Next the ARTERIA BASILARIS proceeds forwards along the pons Varolii in one great trunk: now the pons Varolii is juſt the tuberoſity produced by the crura cerebri and cerebelli, meeting and uniting to form the ſpinal marrow. The corpora olivaria and pyramidalia are juſt two bulgings at the root of the ſpinal marrow; and

and as every great artery, whatever its deſtination may be, gives twigs to thoſe parts which it paſſes over, ſo does the baſilar artery; giving twigs firſt to the corpora olivaria and pyramidalia, next to the crura cerebelli and to the crura cerebri; and as it runs along the pons Varolii it diſtributes little arteries to it from right to left. Theſe little arteries alſo mark the ſides of the pons with ſmall furrows, which are ſeen when the arteries are diſſected away. One of theſe tranſverſe arteries, longer than the reſt, looks like another poſterior cerebri. It goes to the ſeventh pair, or auditory nerve, in the following way: The ſeventh pair of nerves proceeds from the back part of the pons Varolii; and as it goes forwards, the two nerves which it conſiſts of, viz. the portio dura and the portio mollis, are ſeparated from each other by a ſmall and very beautiful artery which ſhoots in betwixt them, and enters along with them into the ear. The baſilar artery alſo gives twigs to the fifth and ſixth pairs of nerves, which ariſe from the fore part of the pons, as the ſeventh pair ariſes from behind.

Arrived at the fore part of the pons Varolii, the baſilar artery gives off almoſt at one point four great arteries, two to the right hand and two to the left. Theſe are the anterior cerebelli and the poſterior cerebri.

2. ANTERIOR CEREBELLI.

THE ANTERIOR ARTERY of the CEREBELLUM, or the upper artery, as it is called, goes off at right angles from the baſilar artery, and bends round the crura cerebri to get to the cerebellum. It gives its branches firſt to the crura cerebelli, to the cerebellum, and to the vermis. Secondly, There is a greater artery going over all the upper part of the cerebellum, (where it lies under the brain,) and alſo another which keeps cloſer to the brain than to the cerebellum, branches over that velum or delicate part of the pia mater which is interpoſed betwixt the cerebellum and brain; and going along it ſupplies the crura cerebri, and arrives at laſt at the place of the nates, teſtes, and pineal gland, and attaches itſelf

itſelf to them. Some of the twigs go down into the fourth ventricle.

3. ARTERIA POSTERIOR CEREBRI.

THE POSTERIOR ARTERY of the brain goes off immediately after this, is like it, runs parallel with it, is larger, goes to the poſterior lobe of the brain, and receives near its root the communicating artery from the carotid, which forms the circle of Willis. Where this poſterior cerebri and the anterior cerebelli run parallel with each other, the third pair of nerves riſes betwixt them. The poſterior cerebri firſt gives a ſmall twig on either ſide to the bottom of the third ventricle, which runs ſo far forwards as to give branches to the thalami, centrum geminum, infundibulum, and to the crura fornicis. Then the main artery bending like that laſt deſcribed round the crura cerebri, and paſſing deep into the great diviſion betwixt the cerebellum and brain, arches upwards towards the back lobes of the brain; but before it arrives there, it gives firſt ſmall twigs to the crura cerebri, and then another notable artery (though ſmall) deſtined for the internal ſurfaces of the ventricles. This is a chief artery of the choroid plexus; it enters the lateral ventricle by the inferior horn; goes along with the cornu amonis: helps to form the choroid plexus; inoſculates, of courſe, with the choroid arteries from the carotid; and twigs alſo go from this artery to the nates, teſtes, and pineal gland, or in other words, to the velum which ſeparates the cerebellum from the brain, which cloſes the ventricle behind, and which covers the pineal gland, and is a membrane or velum to it alſo; the pineal gland, nates, and teſtes, being ſituated neither in any of the ventricles, nor on the ſurface of the brain, but betwixt the ſurfaces of the cerebrum and cerebellum, where the one lies upon the other.

After this ſecond branch to the internal ſurfaces, the great trunk of the poſterior cerebri branches profuſely like a tree all over the back part of the brain, inoſcu-

 lating

lating forwards with the middle artery of the brain, and alſo with the artery of the corpus calloſum.

Thus is the whole brain ſupplied with blood; and next in order come the arteries of the ſpinal marrow.

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§. 2. OF THE ARTERIES OF THE SPINAL MARROW.

I HAVE mentioned none of thoſe ſmaller arteries which the vertebral gives off before entering the ſkull, becauſe being deſtined chiefly for the ſpinal marrow they belong to this ſecond claſs.

The vertebral artery, as it mounts along its canal towards the head, gives at each ſtep, or as it paſſes each vertebra, a delicate twig; theſe little arteries paſs through the intervertebral ſpaces, go to the deeper muſcles of the neck, and inoſculate with the thyroid and cervical arteries. In like manner, other ſmall arteries go inwards to the ſpinal marrow at the place where each nerve comes out. They enter into the ſheath of the ſpinal marrow, and inoſculate with the chief arteries of the medulla ſpinalis.

As the vertebral paſſes through the atlas, both above and below that bone it gives out much larger arteries to the muſcles, as to the recti, trachelomaſtoideus, and complexus, inoſculating largely with the occipital artery: often there is at this point one large and particular artery going out to the back of the neck.

Again, as the vertebral paſſes through the occipital hole, it gives out a litle artery, which accompanies the trunk itſelf up through the foramen magnum, and goes to that part of the dura mater which covers the cuneiform proceſs, and there it inoſculates with the twig of the carotid, which enters along with the jugular vein. This is the poſterior artery of the dura mater.

Next come the arteries of the ſpinal marrow, the anterior of which comes out from the trunk of the vertebral artery; the poſterior (though it alſo ſometimes

comes

comes off from the vertebral before the bafilar is formed) more commonly comes off from the pofterior cerebelli.

1. ARTERIA ANTERIOR MEDULLÆ SPINALIS.

THE ANTERIOR ARTERY of the fpinal marrow is the larger of the two. It was difcovered firft by Willis; it had been looked upon, till the time of Veuffens, as a nerve accompanying the fpinal marrow; becaufe, when empty of blood and uninjected, it is white, and not unlike a nerve. This fpinal artery begins within the fkull by two branches, which unite as they proceed down the fpine. Thefe two branches arife one from each vertebral artery, at the very point where the vertebrals are about to unite to form the bafilar trunk: each artery paffes down its own fide of the fpinal marrow, betwixt the corpora olivaria and the corpora pyramidalia; each artery, before it leaves the fkull, gives twigs to the tuber annulare, and to the pyramidal and oval bodies, for they are the beginnings of the fpinal marrow; and foon after emerging from the fkull *, the two fpinal arteries join fo as to form one anterior fpinal artery. This joining is ufually at the top of the neck, or rather within the fkull, but fometimes fo low as the laft vertebra of the back. Almoft always they join within the head or near it; and the anterior fpinal artery which they form defcends along the fpinal marrow in a furrow which it forms for itfelf. The peculiar office of this artery is to fupply the fpinal marrow and its fheath, which it does by fending continual branches into the fubftance of the fpinal marrow; while other branches go into the fheath itfelf, and pafs out from the fpinal canal along with thofe nerves which go out from the fpinal marrow, accompanied by little proceffes of the fheath, which are named proceffus denticulati.

But this artery, being extremely fmall, would be foon exhaufted, were it not reinforced with fmall arte-

* The artery which accompanies the ninth pair or lingual nerve, often comes from the anterior fpinal artery.

ries coming into the ſheath: theſe paſs through the vertebral interſtices into the ſpinal canal, and are derived from every artery that paſſes near the ſpine. Thus in the neck the ſpinal artery receives twigs from the vertebral arteries, and from the thyroid and cervical arteries; in the back it receives twigs very regularly from each of the intercoſtal arteries, and it receives its twigs from the lumbar arteries when it has got down as low as the loins.

But this ſpinal artery which is continually diminiſhing at laſt fails in the loins; and where the cauda equina begins, viz. in the canal of the os ſacrum, the medulla is no longer ſupplied by a ſpinal artery, but by the ſmall branches of the ſacral arteries, which enter by the ten holes of the ſacrum.

Of thoſe adventitious branches which reinforce the artery of the ſpinal marrow as it deſcends through the ſpine, each gives ſeveral other branches; they give twigs to the muſcles of the ſpine, twigs to the ſubſtance of the vertebræ themſelves, twigs to the ſheath of the ſpinal marrow; and, finally, twigs which inoſculate with the ſpinal artery, and which ſink into the nervous ſubſtance to nouriſh it.

2. ARTERIA SPINALIS POSTERIOR.

THE POSTERIOR SPINAL ARTERY differs in all eſſential points from the anterior: Firſt, There are two poſterior ſpinal arteries which ariſe, not from the baſilar or vertebral arteries like the anterior, but uſually from the arteria anterior cerebri; and they are ſmaller than the anterior ſpinal artery: Secondly, Theſe two arteries give ſmall twigs to the bottom of the fourth ventricle, and then go round from the fore to the back part of the medulla oblongata; but there, inſtead of uniting like the beginnings of the anterior artery, they continue ſeparate, run down the ſpinal marrow as two diſtinct arteries, with very frequent inoſculations betwixt them. This artery is alſo unlike the other in reſpect of its termination, for it diſappears at the ſecond vertebra of the

the loins. Its inofculations with the arteries from without are very free.

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§. 3. ARTERIES OF THE EYE.

THE arteries of the eye come from one branch only, the ophthalmic artery, the branch which the carotid, when it touches the anterior clynoid procefs, fends into the orbit along with the optic nerve. But fmall as this original artery is (no bigger than a crow-quill), the fyftem of arteries which arifes from it is very great; whether we confider their number, the irregular parts which they fupply, or the great inofculations which they form even with the outward arteries of the nofe and face.

Thefe are reafons for fetting this order of arteries apart; and even with all poffible care in the arrangement, it is not eafy to deliver an orderly intelligible hiftory of this artery. The ophthalmic artery fupplies not only the eye itfelf, *i. e.* the globe, but it fupplies alfo all the apparatus, if I may fo call it, of the eye, *i. e.* the mufcles, the lachrymal gland, the eye-lids, and even the forehead and nofe.

1ft, It fends a great branch, which leaves the ophthalmic artery, and takes its own courfe outwards and upwards along the eye, to fupply the lachrymal gland where it is exhaufted. 2dly, The ophthalmic fupplies the eye itfelf, both by that artery which enters into the centre of the optic nerve, called arteria centralis retinæ, and alfo by other arteries which are named the ciliary arteries; becaufe they go onwards to the fore part of the eye, where the ciliary circle is. 3dly, The mufcles are fupplied by an artery which comes from the fame place nearly with thofe ciliary arteries. 4thly, There are two arteries which go down through holes in the focket into the bones and cavities of the nofe; and thefe, as they perforate chiefly the æthmoid bone, are named æthmoidal arteries. 5thly, and laftly, Thofe arteries

 which

which go out upon the forehead and noſe are ſo directly from the trunk of the ophthalmic artery, that they muſt be regarded as the termination of it. This is the ſyſtem of veſſels which comes now to be deſcribed, and this is, perhaps, the beſt order for the deſcription.

FIRST ORDER.

1. ARTERIA LACHRYMALIS.

The lachrymal artery is the firſt branch of the ophthalmic; but, in order to know its place correctly, we muſt firſt obſerve how the ophthalmic artery enters the eye. It comes off from the carotid, where that artery touches the clynoid proceſs; and is ſo cloſe upon the proceſs, that the ſetting off of the ophthalmic is almoſt covered by that projection. It then dives under the optic nerve, and appears on the outer ſide of it; and as the artery goes along through the orbit, it makes a ſpiral turn till it completely ſurrounds the nerve.

The lachrymal artery goes off from the ophthalmic immediately after entering the orbit*, though ſometimes it ariſes from the artery of the dura mater; and then it enters by the foramen lacerum, which is the next opening to the optic hole. It goes off from the ophthalmic about two or three lines after it has entered the ſocket. It goes all along the outer ſide of the orbit, becauſe the lachrymal gland lies in the outer corner of the eye. When it reaches the gland, it is branched out and entirely expended upon it, except that it ſends ſome ſmall twigs forwards to the eyelid. Of theſe vagrant branches, one twig goes to the perioſteum of the orbit, perforates the cheek-bone, and ſo gets into the hollow of the temple, inoſculating with the deep temporal artery; while another little branch goes to the tarſus of the upper eyelid, and another to the tarſus of the lower eyelid, and thus ends the lachrymal artery.

* Sometimes it goes off one or two lines before the ophthalmic enters the optic hole, ſometimes from the middle of the artery.

SECOND ORDER.

In the ſecond order are included the arteries which go to the eye itſelf, viz. the ARTERIA CENTRALIS RETINÆ, and the CILIARY ARTERIES; of which arteries there is none more curious than the arteria centralis retinæ.

I. ARTERIA CENTRALIS RETINÆ.

THIS artery is ſo named becauſe it perforates the optic nerve, runs up through its very centre or axis, enters into the cavity of the eye through the very centre of the optic nerve, and ſpreads its branches all over the retina. It uſually ariſes from the ophthalmic artery, where it turns in the middle of the orbit over the upper part of the optic nerve *; it plunges into the nerve; and this artery, or rather the artery and vein, both (for the vein accompanies it) make ſo large a canal in the centre of the optic nerve, that it ſtands quite open and gaping when the nerve is cut acroſs; and was long known to the older anatomiſts by the name of porus opticus, before the meaning of this orifice or hole was underſtood.

When this artery arrives within the eye, it branches out moſt beautifully upon the retina. The angles and meſhes which this artery makes give the name of retina or net-like to the whole; for the pulpy part of the optic nerve expands into a very thin and delicate web which reſembles mucus. This web has all its ſtrength from theſe branches of the central artery. The branches of the artery, and the mucus-like expanſion of the nerve, lie in two ſeparate layers; and hence ſome anatomiſts reckon the retina a double membrane.

The arteria centralis having given off ſidewiſe theſe innumerable branches to the retina, ſtill goes forwards, plunges through the ſubſtance of the vitreous humour, does not ſtop till it arrives at the back part of the lens, and is of courſe the ARTERIA CENTRALIS OCULI, the

* It may be found ariſing from the ciliary arteries, or ſometimes from the muſcular.

central artery of the eye itſelf. This central artery can no more be ſeen in the adult eye than the arteries of an unprepared bone; but by injecting the ſmall arteries of the eye of a fœtus, of a ſlink Calf, or of any young animal, the arteria centralis oculi is found to diſtribute its branches in the following way: As it goes forwards through the centre of the eye-ball, it gives off its delicate arteries from ſide to ſide, which go along the partitions of the vitreous humour (for the vitreous humour is divided every where by membranes into ſmall honey-comb-like cells). Theſe croſs arteries inoſculate with thoſe of the retina, and are plainly the arteries which ſecrete and ſupport the vitreous humour. The central artery ſtops when it comes to the back of the lens: it is ſcattered in a radiated form, as if by the reſiſtance, into a great many branches. Theſe branches go round all the capſule of the lens, and meet again on its fore part; where, uniting into one or more ſmall arteries, they paſs onwards into the opening of the pupil, and help to form that membrane which in the fœtus ſhuts out the light, protects the eye, and vaniſhes very gradually.

So the arteria centralis retinæ paſſes firſt through the centre of the optic nerve; next through the centre of the vitreous humour; next, after going round the capſule of the lens, it paſſes through the poſterior chamber of the aqueous humour, and terminates in the centre of the pupil. But as theſe laſt arteries, viz. of the pupil, vaniſh ſoon after birth, we may conſider the central artery as ending in inoſculations with thoſe arteries, which coming upwards along the ſides of the eye along with the retina, form a ſtrong circle of arteries at the root of the ciliary proceſs.

2. ARTERIÆ CILIARES.

THE ciliary circle is known, upon looking outwardly at the eye, by that white line which borders the iris, and ſeparates the iris or coloured part of the eye from the white or colourleſs part. That circle marks the place where there is a great concourſe of arteries. The corpus

pus ciliare, or ciliary body, is the part within the eye which lies flat upon the fore part of the vitreous and cryſtalline humours, which is like a ſecond iris behind the firſt, which is extremely vaſcular, and correſponds with the ciliary circle without. This corpus ciliare is radiated (that is a conſequence of the peculiar order and arrangement of its veſſels, which run in rays from the ciliary circle, *i. e.* from the circumference towards the centre). Theſe radii coming from the ciliary circle are called the ciliary proceſſes; ſo that the ciliary circle, corpus ciliare, and ciliary proceſſes, are all parts of the ſame vaſcular organ. This is the part of the eye to which all thoſe arteries go which are next to be deſcribed.

1. Two arteries of conſiderable ſize go off from the ſides of the ophthalmic artery: theſe go along the ſides of the optic nerve; they go towards the ball of the eye; and the one on the outer ſide of the eye is named EXTERNAL CILIARY ARTERY, that on the inner ſide of the optic nerve is named the INTERNAL CILIARY.

2. Theſe two divide themſelves again into two ſubordinate branches: one of them as ſoon as it touches the eye, that is, juſt beyond the implantation of the optic nerve, enters its ſubſtance, and is ſpread out on its choroid coat in a great number of branches, which are named CILIARES BREVES, the ſhort ciliary arteries: the other goes further forward upon the eye before it enters, and even after it enters, it ſtill goes forwards to the very fore part of the eye before it divides; hence named CILIARES LONGÆ.

3. The ANTERIOR CILIARY ARTERIES are ſome ſmall and uncertain branches, which come ſometimes from one ſource, ſometimes from another, but moſt commonly from the muſcular branches; and they go along with the muſcles, and conſequently enter the eye at its fore part juſt where the recti muſcles are inſerted. But, though ſmall, theſe anterior ciliary arteries are of conſiderable number.

From the places at which theſe ſeveral arteries enter the

the ball, one might gueſs a priori how they will be diſtributed through its coats.

The ciliary arteries do not all of them ariſe from the ophthalmic artery; many ariſe from the muſcular branches. As ſoon as they touch the eye-ball, they enter into it near the inſertion of the optic nerve, paſs through the ſclerotic coat (leaving for its nouriſhment a few twigs); they divide ſo, that juſt after they have entered, we can count twenty-five or thirty all round the root of the optic nerves, which go forwards in a radiated form, and are completely diffuſed upon the choroid coat; theſe are the POSTERIOR CILIARY ARTERIES. This coat of veſſels lines the choroid all the way forward to the lens, goes ſtill onwards to the fore part of the lens; and then turning down upon the lens at right angles, it meets with the anterior veſſels, and forms the ciliary circle, and the ciliary proceſſes or radii; a few twigs go ſtill forward upon the uvea and iris, ſo as to make a very important connection of all the vaſcular parts of the eye.

Secondly, The LONGER CILIARY ARTERIES enter the ſclerotic a little further forward, and penetrate at a greater diſtance from the optic nerve. They are two arteries thus diſtinguiſhed; they paſs forward betwixt the ſclerotic and choroid coats, and on approaching the ciliary circle, they each divide and make a circle of inoſculation. Their branches meet each other, and are now joined both by the ſhorter ciliary arteries and by the anterior ciliary arteries; by which conjunction an arterial circle is formed, which correſponds with the outer circle of the uvea, and is called the OUTER CILIARY CIRCLE: this again ſends radii of veſſels, perhaps thirty, inwards, which meeting, form a ſecond circle, the INNER CILIARY CIRCLE.

Thirdly, The anterior ciliary arteries enter the eye at its fore part, and immediately unite with theſe, as has juſt been explained; they help to form the ciliary circle, which is the great conjunction of all the internal veſſels of the eye.

THIRD ORDER.

In this order are included the MUSCULAR ARTERIES, which are the leaſt regular of all the branches of the ophthalmic artery. From one or other branch of the ophthalmic there generally ariſe two muſcular arteries; the one for the upper, the other for the lower muſcles.

1. ARTERIA MUSCULARIS SUPERIOR.

THE UPPER MUSCULAR ARTERY conſiſts of ſmall twigs, which go chiefly to the levator palpebræ and rectus ſuperior; and theſe, though they ſometimes ariſe as two ſmall twigs from the ophthalmic artery itſelf, yet in general come off rather from that artery which, as it goes out by the ſupra-orbitary hole, is named the ſupra-orbitary artery. Theſe muſcular branches of the ſupra-orbitary, then, ſupply the upper muſcles of the eye, as the levator palpebræ, the obliquus major, the rectus ſuperior, and the ſclerotic or outer coat of the eye.

2. ARTERIA MUSCULARIS INFERIOR.

THE LOWER MUSCULAR ARTERY is very generally an independent artery, and pretty large. It comes off from that part of the ophthalmic artery where it is giving off the ciliary arteries. This muſcular branch is large enough to give off ſometimes the arteria centralis retinæ, and often ſome of the ſhort ciliary arteries ariſe from it; it is ſo long as even to reach the lower eyelid. The muſcles which it ſupplies are all thoſe which lie on the lower part of the eye, as the deprimens oculi, abducens oculi, obliquus minor. It alſo gives variable twigs to the ſclerotica, the optic nerve, the perioſteum of the orbit, and ſometimes to the adnata and lower eyelid.

FOURTH ORDER.

The ſet of arteries which ſtand next in order are thoſe which go down into the noſe through the æthmoidal bone, whence they are named æthmoidal arteries. The æthmoidal arteries are, like the other branches of the ophthalmic, pretty regular in their deſtination, but far from being regular in the manner in which they ariſe.

1. ARTERIA ÆTHMOIDALIS POSTERIOR.

The posterior æthmoidal artery is ſo named becauſe it paſſes through the poſterior of two holes which are in the orbit at the joining of the æthmoidal with the frontal bone *. It is an artery by no means regular in its place, coming ſometimes from the ophthalmic trunk, ſometimes from the lachrymal artery, very rarely from the ſupra-orbitary artery. It is of no note: it is the ſmaller of the two æthmoidal arteries; it goes through its hole, and is ſcattered upon the bones and membranes of the noſe. While it is circulating its twigs among the æthmoidal cells, it inoſculates, of courſe, with the naſal arteries of the external carotid.

2. ARTERIA ÆTHMOIDALIS ANTERIOR.

The anterior æthmoidal artery is rather more regular and more important; it paſſes through a larger hole, and is itſelf larger; it comes off more regularly from the ophthalmic trunk, and it goes not down into the noſe, but upwards into the ſkull.

The ophthalmic artery, much exhauſted by giving off many branches, has riſen over the optic nerve, has completed its ſpiral turn, and has juſt got to the inner corner of the eye, where the æthmoid hole is, when the anterior æthmoid artery ariſes from it. It ariſes juſt behind the pulley of the upper oblique muſcle, plunges immediately into its peculiar hole, and, paſſing along a canal

* In deſcribing the ſkull, theſe are named the internal orbitary holes.

within

within the æthmoid bone, it merely gives twigs to the frontal and æthmoidal ſinuſes, and paſſes up by one of the largeſt holes in the cribriform plate of the æthmoid bone. When within the ſkull, it is under the dura mater, betwixt it and the bone; it goes to the dura mater and to the root of the falx, and ſome of its delicate twigs turn downwards again into the noſe, through the ſmall holes of the cribriform plate accompanying the branches of the olfactory nerve.

FIFTH ORDER.

The fifth order of arteries is very numerous, including all thoſe which ſend their twigs outwards upon the face. They are the ſupra-orbitary artery, the artery of the upper eyelid, the artery of the lower eyelid, the artery of the forehead, and the artery of the noſe.

1. ARTERIA SUPRA-ORBITALIS.

The ſupra-orbitary artery is ſo named from its emerging from the ſocket by that notch in the ſuperciliary ridge which we call the ſupra-orbitary hole. It comes off from the ophthalmic artery at the place where it gives off the ciliary and lower muſcular arteries: it ſo often gives off the arteries which go to the upper muſcles of the eye, that ſome have named it the ſuperior muſcular artery. It paſſes onwards, giving twigs to the levators of the eye and of the eyelid, and to the upper oblique muſcles, and to the perioſteum; and before it arrives at the ſupra-orbitary hole, it divides into two twigs; of which one lies deep, and ſupplies the perioſteum of the forehead, inoſculating with the temporal artery; the other lies more ſuperficial, but ſtill is covered by the orbicularis and corrugator ſupercilii, on which muſcles it beſtows all its branches.

2. ARTERIÆ PALPEBRALES.

The two palpebral arteries ariſe from the ophthalmic after it has paſſed the tendon of the obliquus ſuperior,

rior, when it has in a manner emerged from the ſocket, and is lying at the inner angle of the eye: there it commonly gives off two ſmall arteries, one to the upper and one to the lower eyelid; and often the two ariſe by one trunk.

ARTERIA PALPEBRALIS INFERIOR.—The ARTERY of the LOWER EYELID is the branch of the two which goes off the firſt; but it is the ſmaller and leſs regular of the two. Its twigs go, one to the union of the two tarſal cartilages, to the caruncula lachrymalis, and to the adjoining part of the adnata; another goes deeper, viz. to the lachrymal ſac, and even into the æthmoid cells; and a third twig runs along the margin of the tarſus, named tarſal artery, ſupplying the Meibomean glands.

ARTERIA PALPERALIS SUPERIOR.—The ARTERY of the UPPER EYELID ariſes along with the lower palpebral, or near it; it gives few branches; one keeps to the angle of the eye, and ſupplies the orbicularis oculi, the caruncula, and the tunica conjunctiva; another having pierced the fibres of the oblique muſcle, runs along the borders of the tarſus, inoſculating with a ſimilar branch of the lachrymal artery, and forming an arch along the upper tarſus as the other does below.

3. ARTERIA NASALIS.

THE NASAL ARTERY goes off at the edge of the orbit, riſes over the lachrymal ſac, and over the ligament of the eyelids; it firſt gives a twig upwards to the root of the frontal muſcle; then another goes down over the lachrymal ſac, and after giving branches to the ſac, goes to the orbicularis muſcle, and inoſculates with the infraorbitary artery; and laſtly, the moſt remarkable branch of this artery, from which indeed it has its name, runs down upon the ſide of the noſe, making a beautiful network, and inoſculating with the laſt branch of the labial artery, called angularis, which runs up to meet it *. This

* Some of its branches abſolutely penetrate the cartilages of the noſe, and ſo get acceſs to the Schneiderian membrane, and ſupply it with blood.

is quite a cutaneous artery; many of its twigs go to the ſkin, it is felt beating ſtrongly; it was often opened when arteriotomy was more regarded than it is now.

4. ARTERIA FRONTALIS.

THE FRONTAL ARTERY is now to be diſtinguiſhed from the ſupra-orbital; for the ſupra-orbital riſes deep in the ſocket, emerges by the ſupra-orbitary-hole, paſſes along chiefly betwixt the bone and muſcles, and makes no remarkable figure upon the face; while this, the frontal artery, keeps chiefly upon the ſurface of the muſcles, is quite ſubcutaneous, has nothing to do with the ſupra-orbitary hole, and riſes beautifully upon the forehead. It is a delicate and ſlender artery, not ſo large as the naſal, and looks like one of its branches; it gives off firſt a branch to the eye-lids, named ſuperciliary artery, which ſupplies the root of the frontal and the upper part of the orbicularis muſcles; it ſends an aſcending branch which dives under the frontal muſcle, and belongs chiefly to the os frontis and pericranium. This is the little artery which often makes a perpendicular groove in the os frontis. The chief branch of the artery continues ſubcutaneous, is felt beating along the forehead, belongs chiefly to the ſkin of the forehead and to the hairy ſcalp, and mounts to the top of the head, to the place of the fontanelle, where it has free inoſculations with the temporal artery.

This laſt branch is the end of the occular or opththalmic artery, of which the branches are ſo irregular in their origin, that the moſt diligent anatomiſts have declined that part of the deſcription, and yet have arranged the branches upon that ſcheme, viz. the points from which the ſeveral twigs ariſe: whereas I have thought it more prudent, ſince the branches are regular in reſpect of the parts which they ſupply, to arrange them according to thoſe parts, viz. the lachrymal gland, the eyeball, the muſcles, the æthmoid cells, the face; an order which alſo very nearly correſponds with the order in which the arteries ariſe. The learning and re-

 membring

membring these arteries, it is right to acknowledge, is a task more difficult than useful; more suiting the severe anatomist, than the practical surgeon; who yet, if he do his duty, will learn all; and as he learns much, must expect to forget much.

CONCLUSION.

BEFORE I leave this difficult subject, I stop one moment to explain a point which might leave some confusion in the reader's mind; and regarding chiefly those little arteries which belong to the membranes of the brain.

It is of great importance in studying the brain, to know the manner in which its membranes are connected with it; and it is especially to be remarked, that the internal surfaces, or, in other words, the cavities of the brain, need to be supported, nourished, and supplied with blood as much as the external surface; and that for this end the pia mater turns inwards and lines all the cavities of the brain.

At different points the pia mater and its arteries take various forms, and are called RETE MIRABILE, VELUM, or CHOROID PLEXUS, according to that form.

The RETE MIRABILE has already been explained, as being that division and reunion of the branches of the carotid artery by which the force of the ascending blood is broken before it enters the brain. In many of the lower animals this provision of nature is most curious and particular; but in Man it would appear, that the erect posture in which he walks, the contortions of the carotid artery as it enters the skull, the manner in which it lies in the cavernous sinus, and, finally, the minute division which it undergoes by spreading over the pia mater before it enters the brain, are sufficient. In Man there is not the smallest vestige of a rete mirabile; and whenever we find a rete mirabile described in Man (as often

often it has been defcribed), we find invariably that it means no more than the plexus of delicate veffels which go out from the firft twigs of the carotid artery, either to fupply the membranes or to enter into the cavities of the brain; and accordingly we find thefe authors calling it "a beautiful beginning of a rete mirabile;" "an imperfect rete mirabile," &c.

The VELUM, as it is called, is that netted form which the pia mater affumes often about the bafis of the brain, whenever the fmaller arteries are numerous; for the inofculations of the arteries are like a net-work; the arteries, full of blood or of injection, are opaque and are very apparent; while the membrane upon which they run is lucid, diaphanous, and is fcarcely feen. A velum or net of this kind appears on every fmooth and uniform furface of the bafis of the brain; but the moft remarkable of all is that which, beginning betwixt the cerebrum and cerebellum, is continued forward to the very centre of the brain betwixt the fornix and the third ventricle, extending from the plexus choroides of one fide to the other. This is called the VELUM INTERPOSITUM.

The PLEXUS CHOROIDES again is merely another variety or form of the pia mater. The great choroid plexus is a membrane which lies upon the bottom of each lateral ventricle; it is netted and extremely vafcular, not unlike the chorion of fome animals, whence it is named. It confifts partly of arteries, but chiefly of veins; it conveys fome blood to the internal furfaces of the brain, but returns much more.

But although the choroid plexus of the two lateral ventricles be the chief ones, the third and the fourth ventricles have each their plexus or vafcular webs. The chief points by which thefe vafcular webs of the pia mater enter are by the anterior and pofterior horns of the lateral ventricles; at which points, and indeed at all the lower parts of the brain, the ventricles muft be confidered as fhut, fince thefe vafcular linings, as they enter, adhere on all fides: but may alfo be confidered as open, fince they admit thefe membranes, fince they

are ſhut only by their ſlight adheſion, and may be opened by pulling the parts gently aſunder.

This, then, is a general explanation of that vaſcular part of the pia mater which covers all the baſis, and lines all the cavities, of the brain. It is one continuous membrane, under the various titles of rete mirabile, which ſome older anatomiſts uſe; of velum, a name chiefly repeated by Haller; and of plexus choroides, a name univerſally uſed for that net-work of veſſels which lies out upon the floors of the ventricles. It will be ſeen hereafter how greatly a knowledge of theſe inflections contributes to the right underſtanding of the brain and its parts and cavities.

CHAP. II.

OF THE ARTERIES OF THE ARM.

THE ſubclavian arteries ariſe from the arch of the aorta. The left ſubclavian ariſes from the extremity of the arch, and juſt where the aorta is turning down towards the ſpine. It is longer within the thorax, runs more obliquely to paſs out of the cheſt, receives in a leſs favourable direction the current of the blood. But the right ſubclavian ariſes from the aorta by that artery which is called the ARTERIA INNOMINATA; for it is an artery which can have no name, being neither the carotid nor the ſubclavian, but a trunk common to both. It is large, riſes from the top of the aortic arch, receives the blood in the moſt direct manner; from which phyſiologiſts have deduced thoſe conſequences which have been already explained *.

1. The artery of the arm, as it proceeds, changes its name according to the parts through which it paſſes. It

* Douglas ſays the left is ſhorter, which I can by no means underſtand.

is

is named ſubclavian within the breaſt, axillary in the arm-pit, brachial as it goes down the arm, and when it divides at the bending of the arm its two branches are named the radial and ulnar arteries, after the radius and ulna, along which they run, until at laſt they join to form vaſcular arches in the palm of the hand.

Nature has thus arranged and divided the parts of this artery; and the ſtudy of its branches becomes eaſy to thoſe who will firſt condeſcend to obſerve this ſimple arrangement and the parts through which it goes. 1ſt, While the artery is within the breaſt, it lies tranſverſely acroſs the root of the neck; it ſupplies the neck, the breaſt, the ſhoulder; it gives all its branches upwards into the neck, or downwards into the breaſt: upwards it gives the vertebral to the inſide of the neck (if I may uſe an expreſſion which cannot now be miſunderſtood); the cervical, which goes to the outſide of the muſcles of the neck; the thyroid, which goes to the thyroid gland. While it gives off from its oppoſite ſide downwards, and into the cheſt, the mammary, which goes to the inner ſurface of the breaſt; the upper intercoſtal artery which ſerves the ſpace betwixt the uppermoſt ribs; the mediaſtinum and pericardium and even the diaphragm, though far diſtant, receives branches from this mammary artery.

2. When the artery, having turned over the ſloping part of the cheſt, glides into the axilla, and lies deep there betwixt the ſcapula and the thorax, what parts can it ſupply, or what veſſels can it give off, but ſcapular and thoracic arteries? Its branches accordingly are three or four ſlender arteries to the thorax on one hand, named the four thoracic arteries, which give twigs to the glands, the pectoral muſcles, and the breaſt or mamma; and on the other hand it gives off firſt great articular arteries which ſurround the joint, and ſtill great ſcapular arteries which ſurround the ſcapula, and nouriſh all that great maſs of fleſh which lies upon it.

3. But when this artery takes the name of the humeral artery, and paſſes along the arm, it muſt be ſimple, as the arm is ſimple; for it conſiſts of a bone of

of one mafs of mufcles before and another behind: the artery of courfe runs along the bone undivided, except that it gives off one branch, which runs parallel along with the main artery, and which running deeper among the flefh, is named mufcularis or profunda.

4. It divides at the bend of the arm, in order to pafs into the fore-arm in three great branches. In wounds thus low, all danger of lofing the arm from wounds of the artery, unlefs by the grofs ignorance or fault of the furgeon, is over: we do not attend fo much to the parts which it fupplies, or, in other words, to its inofculations, as to the parts againft which the great branches lie. We obferve here, as on all occafions, the artery feeking protection, and running upon the firmeft parts: its three branches now pafs; one along the radius, another along the ulna, a third along the interoffeous membrane.

5. In the palm of the hand we find the artery ftill following the order of the bones; and as the carpal bones are as a centre or nucleus, upon which the metacarpal and finger bones ftand like radii, the palmar artery forms a complete arch, from which all the fingers are fupplied by arteries, iffuing in a radiated form.

Of all thefe fubdivifions the fubclavian artery is that which feems the leaft important to know; and yet without a perfect knowledge of it, how fhall we underftand many important arteries of the neck or fhoulder? How fhall we underftand the anatomy of the greateft of all the nerves, viz. the fympathetic nerve which twifts round it? How fhall we judge rightly of tumours near it, or of aneurifms which fo often mount along this artery from the arch of the aorta until they are felt here?——Of the fecond divifion of the artery, viz. where it lies in the axilla, the importance is moft unequivocal; fince every attempt to ftop hæmorrhages, by compreffing this artery, requires a knowledge of it; fince every full bleeding wound near this place alarms us, and requires all our knowledge; fince every tumour that is to be extirpated opens fome of its branches; fince we

we cannot cut off a cancerous breaſt, or the glands which ſhould be taken along with it, without cutting the thoracic arteries.—Next the artery of the arm, ſimple as it is, intereſts us greatly. It is this ſimple artery which is hurt in aneuriſms; it is its delicate, I had almoſt ſaid capillary, branches, which are to eſtabliſh a new circulation, and to ſave the limb. We have indeed no apprehenſions of loſing the limb for want of blood (the continual ſucceſs of our operations having eſtabliſhed this point); yet it is moſt intereſting to obſerve the extreme ſmallneſs of theſe branches, as an aſſurance to us in other caſes of danger; though I do indeed believe, that there cannot in any ſimple wound in any limb be the ſmalleſt danger from this much dreaded obſtruction of the blood.

The arteries of the fore-arm are more intereſting ſtill; for if we will be ſo ſelfiſh as to conſider the difficulties of the ſurgeon merely, wounds of the arteries in the fore-arm are very diſtreſſing. Theſe arteries lie deep among the muſcles, drive their blood (when wounded) through the whole arm, and either occaſion a difficult and moſt painful diſſection, or cauſe a deep and gangrenous ſuppuration; ſo that whether the ſurgeon be ſo dexterous as to ſecure the arteries, or ſo timid as to leave the arm in this woeful condition, the patient is to undergo ſuch ſufferings by pain, or by a long diſeaſe, as muſt intereſt us greatly.

The arteries even of the wriſt and hand, though ſmall, are important. The difficulty of managing wounds of theſe arteries ſtands but too often recorded in all kinds of books for us to doubt the fact. If many have died after frequent bleedings from theſe arteries, though under ſkilful hands, what ought we not to ſubmit to in the way of ſtudy and labour to acquire and to retain a knowledge of theſe arteries; ſince by that alone every thing that is ſurgical in tumours, aneuriſms, amputations, is well or ill performed according to our degree of knowledge; and ſince, according to our degree of knowledge, we are diſengaged in our minds, and have free poſſeſſion of our judgment, to do any thing which

may be required? In ſhort, as we proceed along this artery, we ſhall perceive that each diviſion of it riſes in importance; or at leaſt, that if wounds about the axilla be more dangerous, they are proportionably rare; that if accidents about the wriſt or hand be leſs dangerous, they are, however, more frequent, ſo as to deſerve every degree of attention.

I. OF THE SUBCLAVIAN ARTERY.

THIS artery is ſo named from its paſſing under the clavicle by which it is protected; and we include under this diviſion all that part of the artery which lies betwixt the arch of the aorta and the outſide of the clavicle, where the artery comes out upon the cheſt. Here the artery is of a very great ſize; it lies directly acroſs at the top of the cheſt and root of the neck; and like a cylinder or axis, it gives its branches directly upwards and directly downwards to the throat, to the neck, and the parts within the cheſt. Upwards it ſends the vertebral, the thyroid, the cervical, and all the humeral arteries; downwards it ſends the upper intercoſtal artery, and alſo the internal mammary, which, beſides its going along the inner ſurface of the cheſt, gives branches to the pericardium, mediaſtinum, thymus, and other parts.

1. ARTERIA MAMMARIA INTERNA.

THE INTERNAL MAMMARY ARTERY is the firſt which the ſubclavian gives off; it is of the ſize of a crow-quill, long, ſlender, its ramifications very beautiful. On each ſide of the cheſt the mammary artery paſſes down along all the inner ſurface of the ſternum, and ends at the cartilago enſiformis in numerous inoſculations with the epigaſtric artery; for the epigaſtric ariſes from the femoral at the groin, juſt as this does from

from the ſubclavian at the top of the cheſt, and runs upwards along the belly, as this the mammary runs downwards along the breaſt till they meet each other midway. This is an inoſculation, which fifty years ago was much noticed. Phyſiologiſts deduced the moſt important conſequences from it, aſcribing the connection of the breaſt and womb to the flux and reflux, to the alternate ſtoppage and acceleration of the blood in theſe veſſels; although the ſympathy of the breaſts and womb is plainly a connection which Nature has eſtabliſhed upon other laws, upon a kind of ſympathy ſuch as we ſee everywhere in the ſyſtem, but can in no inſtance explain.

The courſe of the mammary artery, and the order of its branches, is this: It goes off from the lower and fore part of the axillary artery; it lies on the outſide of the membranous bag of the pleura; and conſidering the pleura as ending in an obtuſe and riſing apex, the mammary artery lies at firſt a little behind the pleura, its firſt movement is to riſe and turn with an arch over the top of the pleura or bag which incloſes the cavity of the cheſt; there it deſcends again, and paſſes betwixt the ribs and pleura; the artery runs along the inſide of the thorax under the middle of the cartilages. At the ſeventh or eighth rib the mammary itſelf emerges from the thorax, and becomes an external artery; it firſt ſends a branch towards the enſiform cartilage, which plays round it, and then it goes to the upper part of the abdominal muſcles by two diſtinct branches, the one of which is internal, the other external. The internal branch goes into the belly or ſubſtance of the rectus muſcle, deſcends nearly as far as the navel, and inoſculates with the epigaſtric artery. The external branch turns off to one ſide, goes rather to the lateral muſcles of the abdomen, eſpecially to the two oblique muſcles, and it inoſculates more with the lumbar arteries; and ſo the mammary ends. But as it paſſes down along the cheſt, it gives the following branches:

Firſt, Where it is paſſing the clavicle, bending to go downwards, it gives a ſmall retrograde branch which follows

follows the courſe of the clavicle, and goes to the muſcles and ſkin of the neck *.

Secondly, It gives an artery, or rather arteries, to the thymus, ARTERIÆ THYMICÆ. Theſe are in the adult extremely ſmall, becauſe the gland itſelf is ſo; but in the child the gland is large, the upper part lies before the trachea, the lower part lies upon the heart, or rather upon the pericardium betwixt the two lobes of the lungs: the upper end then is ſupplied by the thyroid arteries; the middle part is often ſupplied by a diſtinct and particular branch, viz. by this ARTERIA THYMICA coming from the mammary, but this is far from being always ſo; the loweſt part of the gland has twigs from thoſe arteries which properly belong to the mediaſtinum, upon which it lies, or to the pericardium, or to the diaphragm.

Thirdly, The mammary gives alſo the upper artery of the diaphragm, its lower artery being the firſt branch of the aorta within the abdomen. This upper artery of the diaphragm is named ARTERIA COMES NERVI PHRENICI, becauſe it accompanies the phrenic nerve. The phrenic nerve is paſſing from the neck (where it ariſes) into the cheſt, by the ſide of the axillary artery, when it receives from the mammary this ſmall artery which goes along with it; and this artery (which is ſo extremely ſmall that nothing but its regularity can give it any importance) goes down through the whole cheſt, accompanying the phrenic nerve over the pericardium till they arrive together on the upper ſurface of the diaphragm, and ſpread out there. This artery, ſmall as it is, gives twigs as it paſſes along to almoſt all the parts within the cheſt.

Fourthly, The mammary gives an artery to the pericardium, which may be called the UPPER PERICARDIAC ARTERY; and which is of ſuch importance, that generally when it does not come off from the mammary, it comes from the ſubclavian itſelf, or even from the aorta. It belongs to the upper and back part of the pericardium.

* Sabbatier is ſo confuſed, and copies Haller ſo ill, that he miſtakes this for the tranſverſalis humeri, which is really an important artery.

Fifthly,

Fifthly, The pericardium has another artery from the mammary, which belongs to that part of the heart which is united to the diaphragm: it is thence named by some ARTERIA PHRENICO-PERICARDIACA.

Sixthly, The mammary gives many small arteries to the mediastinum; for the mammary is covered only by the sterno-costalis muscle, which is often hardly visible in Man, so that the artery may be said to lie upon the pleura, betwixt it and the ribs. The mediastinum is just that doubling of the pleura which descends from the sternum to the spine, and of course many small arteries go down from the lower surface of the sternum along the pleura into the mediastinum, and by that to the pericardium, or even to the membrane of the lungs.

The mammary, as it goes downwards, sends branches through the interstices of the ribs; two twigs pass through each interstice, going to the intercostal muscles, and to the muscles which lie upon the thorax, as the pectoral muscles; also to the mamma, to the obliquus externus abdominis, they form loops of inosculations round the ribs with the proper intercostal and thoracic arteries. These twigs pass through the interstices of the six or seven upper ribs, but at the seventh the artery itself comes out. They are too numerous and too small to be either counted or named.

Seventh, The mammary, before it terminates in the two branches, of which one keeps the middle and goes to the rectus muscle, while the other goes outwards to the oblique muscle, as already described, gives about the place of the sixth rib a branch which, in place of passing out of the thorax, keeps to its inner surface, goes downwards along the seventh, eighth, and ninth ribs, makes its inosculations there with the intercostal and other arteries, and ends in the side of the diaphragm, and in the transverse or innermost muscle of the abdomen, which indigitates, as we call it, with the diaphragm. From this destination it is sometimes named the RAMUS MUSCULO-PHRENICUS.

2. ARTERIA THYROIDEA INFERIOR.

THE LOWER THYROID ARTERY, whose branches go to the neck, the shoulder, and the thyroid gland, arises from the fore part of the subclavian artery, close upon the origin of the internal mammary. It is there covered by the root of the mastoid muscle. It buds out from the root of the great axillary artery, in the form of a short thick stump, which immediately divides whip-like into four small and slender arteries.

1. The main branch of this artery is again named the *ramus thyroideus arteriæ thyroideæ*. This thyroid artery is the first great branch; it does not ascend directly, but moves a little inwards towards the trachea, from which the root is a good deal removed; it bends behind the carotid artery, is tortuous, ascends by the side of the trachea till it touches the lower lobe of the thyroid gland; it spreads upon it like a hand, inosculates very freely with the upper thyroid artery, and nourishes the gland. This branch moreover gives some twigs upwards to the lower constrictors of the pharynx and to the œsophagus; but its chief arteries, beside those which plunge into the gland, are its TRACHEAL ARTERIES. These tracheal arteries, two or three in number, are reflected along the trachea, turn down with it into the chest, and reach even to the bifurcation of the trachea, where, inosculating with the intercostal arteries, they form a most beautiful net-work.

2. The ascending thyroid artery, or *thyroidea ascendens*, is a small and delicate branch, which lies pretty deep, going off rather from the back part of the artery; it supplies all the deep parts of the neck, and even penetrates the vertebræ; it soon divides into an irregular number of branches; the artery keeps almost close to the naked vertebræ, lying under most of the muscles; its general tendency is upwards, surrounding the neck in a spiral form. Its chief twigs are, first, some which go towards the surface, *i. e.* to the muscles which lie

over

over the artery, as to the ſcalenus, the maſtoid muſcle, the levator ſcapulæ, and the ſplenius; and twigs of this artery play over the rectus capitis and the anterior ſurface of the vertebræ, and attach themſelves to the eighth pair of nerves, and to the ganglion of the ſympathetic nerve. Its deeper arteries again go to the inter-tranſverſarii and other muſcles which lie cloſer upon the neck; and theſe are the branches which paſs in through the intervertebral holes, and penetrating the ſheath of the ſpinal marrow, and following its nerves, inoſculate with the ſpinal arteries.

3. The tranſverſe artery of the neck, or tranſverſalis colli, is an artery of the ſame kind with the laſt, viz. chiefly deſtined for the muſcles, but more ſuperficial. It paſſes obliquely round the neck outwards and upwards, goes under the trapezius muſcle, and covered by it ſends branches as far as the occiput. Its twigs are diſtributed thus: Firſt to the maſtoid muſcle and to the ſkin; next to the trapezius, levator ſcapulæ, and ſplenius; then a long branch paſſing obliquely upwards over the ſplenius, and under cover of the trapezius, gives twigs to thoſe muſcles, and ends in inoſculations with the lower branches of the occipital artery; and laſtly, another branch goes downwards towards the ſcapula and ſhoulder.

4. The laſt branch of this artery is the TRANSVERSALIS HUMERI; an artery ſo important in its deſtination, and ſo irregular in its origin, and ſo frequently ariſing as a diſtinct and particular branch, and having ſo little relation to theſe trivial branches of the thyroid artery, that I ſhall deſcribe it by itſelf.

3. ARTERIA VERTEBRALIS.

THE vertebral artery ariſes next from the upper part of the ſubclavian artery; and running upwards and backwards but a little way, it plunges into the hole deſtined for it in the vertebræ; and it has been already deſcribed through all its courſe both within the bony canal and within the brain.

4. ARTERIA CERVICALIS PROFUNDA.

THE deep cervical artery comes next in order; it is generally the leaſt important of all the branches from the ſubclavian artery, and the leaſt regular in its place. It often comes from ſome other branch, and often it is entirely wanting: its courſe reſembles a good deal that of the tranſverſalis colli, *i. e.* it goes to the deepeſt muſcles of the neck, and to the vertebræ, and ends about the occiput; it uſually ariſes from that part of the ſubclavian artery where it is juſt going to paſs, or has already paſſed, betwixt the ſcaleni muſcles. Its branches are few in number, it gives branches to all the ſcaleni muſcles; others alſo which play over the anterior ſurface of the vertebræ and the deep muſcles of the neck, as the ſpinalis colli, inter-tranſverſarii, the root of the ſplenius and trachelo-maſtoideus; the complexus alſo receives a branch, which uſually inoſculates with the occipital artery.

5. ARTERIA CERVICALIS SUPERFICIALIS.

THE SUPERFICIAL CERVICAL ARTERY is ſtill leſs regular, being very often ſupplied by the thyroid. Its courſe is directly the reverſe of the laſt, running rather outwards and downwards, or, in other words, belonging rather to the ſhoulder than to the neck. The ſubclavian artery has got from under the muſcles, and has paſſed the ſplenii a little way before it gives off this ſuperficial cervical. This artery immediately attaches itſelf to the plexus of the brachial nerve, and is indeed hidden in the plexus: its firſt branch is given to the plexus, but its next and chief branch goes acroſs to the top of the ſhoulder; it ſends branches to the levator ſcapulæ, trapezius, and even to the ſkin; while a deeper branch goes to the ſplenius and complexus, where theſe muſcles ariſe in the neck; and when this artery is large, it ſends branches along the margin of the ſcapula, which

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go even to the ferratus major, rhomboides, latiffimus dorfi, &c.

AFTER enumerating thefe jarring names, I perceive the neceffity of arranging once more thofe arteries which go to the neck. Let the ftudent then obferve, 1. That the vertebral artery goes to the brain, that the cervical arteries belong to the mufcles of the neck. 2. That the thyroid gives two arteries to the neck, the thyroidea afcendens and the tranfverfalis colli. 3. That when a fecond fet of arteries for the neck begins to be enumerated, the name is changed; that of colli is dropped, and that of cervicis adopted. 4. That as there are two branches of the thyroid going to the neck, viz. the afcending thyroid and the tranfverfalis colli, there are alfo two entire arteries going to the neck, and which come off immediately after the thyroid, viz. the cervicalis profunda more conftant, and the cervicalis fuperficialis which is lefs regular.

6. ARTERIA INTERCOSTALIS SUPERIOR.

THE UPPER INTERCOSTAL is given to fupply the intercoftal fpace betwixt the two uppermoft ribs, becaufe the aorta which gives out all the other intercoftals, regularly one for each rib, does not begin to give them off till after it has made its turn downwards; of courfe it leaves the two upper ribs without arteries. To fupply this, then, is the office of the fuperior intercoftal artery, which is about the fize of a crow-quill, and goes off from the fubclavian generally next after the vertebral and thyroid arteries. It comes from the upper and back furface of the fubclavian trunk; it turns downwards and backwards, and lodges itfelf by the fide of the fpine in the hollow where the fpine and the firft rib are joined, and where the firft thoracic ganglion of the great intercoftal nerve lies. Before it takes its place betwixt the ribs, as the intercoftal of the two upper fpaces, it fends a branch upwards upon the face of the lower vertebræ of the neck, which is given to the fcaleni, to the lon-

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gus colli mufcle, and to the nerves: next it gives off the higheft intercoftal artery for the fpace betwixt the firft and fecond ribs, which artery divides into two branches; one perforates the thorax, and goes out upon the back, and fupplies the mufcles which lie flat upon the back of the cheft; while another branch, the proper intercoftal branch, runs along betwixt the ribs.

Next it gives off a fecond intercoftal artery, which alfo has its external and internal branches, and of which a branch inofculates over the third rib with the uppermoft intercoftal of the aorta. Befides thefe, it gives alfo fmall branches to the œfophagus, which inofculate with the tracheal arteries; and it gives branches to the fpinal marrow, which pafs into the canal along the holes for the nerves; and which not only fupply the fheath, but alfo inofculate with the arteries of the fpinal marrow itfelf.

7. ARTERIA SUPRA-SCAPULARIS.

THE SUPRA-SCAPULAR ARTERY, or the fuperior fcapular artery, is one of fuch magnitude, and is fo different in fize and deftination from the cervical and other fmall arteries of the neck, that it ought to be defcribed apart; though of great fize and importance, it is yet fo little known, that Sabbatier does not even defcribe nor name it.

The SUPRA-SCAPULAR ARTERY very often comes off from the THYROID artery; in which cafe it is the laft in order of all the branches of the thyroid, that is to fay, the neareft to the fhoulder, and then it is named TRANSVERSALIS HUMERI, becaufe of its going acrofs the root of the neck to the fhoulder. Sometimes it arifes from the cervicalis fuperficialis; but then it is a fmall artery, and I fufpect it reaches in fuch cafes no further than the tip of the fhoulder, and does not defcend to the fcapula. Often I fee it arifing as a diftinct artery, large, very long, tortuous like the fplenic artery, and almoft equalling it in fize; running acrofs the root of the neck, till at the top of the fhoulder it dives

dives under the acromion procefs; and then paffing through the notch of the fcapula, fupplies all the flefh of its upper furface.

The reafon of my naming it fupra-fcapular artery, is its paffing thus over the fcapula, while another, the largeft branch of all thofe proceeding from the axillary artery, is named fub-fcapularis, from paffing under the fcapula.

To repeat the origin then of this fupra-fcapular artery, it arifes fometimes as an independent artery, and is fo great, that we wonder that it does not always do fo: often it arifes from the thyroid, is its laft branch, and is named TRANSVERSALIS HUMERI, authors not obferving that it belongs abfolutely to the fcapula; it rarely arifes from the cervicalis fuperficialis; and when it does fo, it is fmall: often in a ftrong man it arifes apart; and when it does arife from the thyroid or cervical arteries, it is fo large as to annihilate as it were all the other branches of the artery from which it arifes.

Where this artery paffes out of the cheft it is covered only by the root of the maftoid mufcle; and it gives twigs to the maftoid, to the mufcles which afcend to the throat, to the fubclavian mufcle, to the fat, jugular vein, and fkin.

Next it gives a fuperficial branch to the fkin, trapezius, and other fuperficial parts about the fhoulder.

Next it turns over the acromion procefs, paffes through the fupra-fcapular notch, with many windings and contortions; fpreads itfelf over all the outer furface of the fcapula, both above and below the fpine, and is the fole fupra-fcapular artery. The manner of its fpreading is this; having paffed through its hole in company with the fupra-fcapular nerve, the inftant that it has paffed the hole and begins to lie flat upon the fcapula, it fends off two branches, one on either hand at right angles; and of thefe one goes along the upper border of the fcapula towards its bafis, the other goes in the other direction towards the fhoulder-joint, and circles round the upper fide of the fpine or ridge of the fcapula.

The main artery having firft perforated the fcapular notch,

notch, and given theſe two ſmall branches, next makes a ſecond perforation, viz. by paſſing under the root of the acromion proceſs; and then it again divides into large branches in which it ends. The one branch runs all along the root or baſe of the ſpine or high ridge; the other branch runs nearly in the ſame direction, but lower down, viz. nearer that edge where the great ſub-ſcapular artery runs; and with which, of courſe, it makes many free inoſculations.

This artery lies ſo acroſs the neck that it may be cut, eſpecially in wounds with the ſabre; and in a big man it is of ſuch ſize as to pour out a great quantity of blood. It is neceſſary for the ſurgeon to remember the great ſize of this ſupra-ſcapular artery, its long courſe over the ſhoulder, at what place it ariſes within the cheſt, and how it may be compreſſed. But in another ſenſe alſo it is peculiarly important; for the ſupra-ſcapular artery makes inoſculation with the lower ſcapular artery, freer, and fuller, than in almoſt any other part of any limb. One can hardly force tepid water through thoſe ſmall arteries which ſupport the arm after the operation for aneuriſm; but the inoſculations of this ſupra-ſcapular artery are ſo free, that often, though I have tied the arteries with great care, the very coarſeſt injection has gone round by it; and when I deſired only to inject the head, I have found the arteries of the arm entirely filled. The concluſion which this leads to in wounds of the axillary artery is too obvious to need any further explanation.

II. OF THE AXILLARY ARTERY.

THIS artery aſſumes the name of axillary, where it lies in the arm-pit or axilla. The ſcaleni muſcles being attached to the ribs, the artery paſſes firſt through betwixt the firſt and ſecond ſcalenus; next it paſſes out from under the arch of the clavicle, where it was protected:

tected; then it falls over the breaſt in a very oblique di rection; it inclines outwards towards the axilla, lies flat upon the ſlanting convexity of the cheſt, is covered by the pectoral muſcles, becauſe the pectoral muſcles ariſe from the clavicle, under which the artery paſſes; but far from being protected, it is ſo far expoſed as to be eaſily felt beating, and it is at this point only that it can be rightly compreſſed. It declines ſtill outwards and downwards, till at laſt it gets ſo deep into the arm-pit, and ſo much under the ſcapula, as to lie betwixt the ſerratus anticus and ſub-ſcapular muſcles. There it is rightly called the axillary artery. In this hollow it lies ſafe, protected by the deep borders of the pectoral muſcle before, and of the latiſſimus dorſi behind, ſurrounded with fat and glands, incloſed within the meſhes of the plexus, or great conjunction of nerves, which go to the arm, ſurrounded alſo by all the veins of the arm, which twine round it in a wonderful manner. Here it gives off the thoracic arteries to the thorax, and the ſcapular arteries to the ſhoulder. In ſhort, the axilla itſelf is a complicated ſtudy; but in all that reſpects the arteries it may be made very eaſy and plain. But let the ſurgeon remember that it is only by a perfect knowledge of the arteries, a bold ſtroke of the knife, and a maſterly uſe of the needle, that the patient is to be ſaved from bleedings after wounds hereabouts! for the old ſtory of compreſſing the axillary artery above the clavicle is now of no credit with any ſurgeon of knowledge or good ſenſe.

As the artery turns over the borders of the cheſt, it gives one or two twigs to the adjacent parts, as to the ſcaleni, and to the great nerves which lie over the artery, and to the ſerrated muſcle, where it lies under the ſcapula: but theſe branches are ſo ſmall that it is unneceſſary either to number or deſcribe them. The thoracic or external mammary arteries are the firſt important branches; they are four in number, and they are named after their place or office.

1. ARTERIA THORACICA SUPERIOR.

THE UPPER THORACIC ARTERY, being the firſt, lies of courſe deep in the axilla. It comes off about the place of the firſt or ſecond rib; it lies betwixt the leſſer pectoral and the great ſerrated muſcles; it gives its chief branches to theſe muſcles, and it alſo gives other branches to the intercoſtal muſcles and the ſpaces betwixt the ribs. But, upon the whole, it lies very deep, is ſmall, is ſo ſhort that the next is entitled thoracica longior; it is an artery of little note.

2. ARTERIA THORACICA LONGIOR.

THE LONG THORACIC ARTERY is more important, ſupplying all the great pectoral muſcles and the mamma. It was named the external mammary artery; but we are the more willing to change the name, ſince it has no likeneſs to the internal mammary artery; is in no reſpect a counter-part to it; it might be named the pectoral artery. It is long, not tortuous, but ſtraight and ſlender, and about the ſize of a crow-quill. It is needleſs to deſcribe an artery ſo variable in its branches as this is; it is ſufficient to ſay, that after giving ſmall twigs to the axillary glands, it terminates with all its larger branches in the pectoral muſcle, mamma, and ſkin, and in inoſculations with the intercoſtals and internal mammary; it is very long, deſcending ſometimes ſo low as to give branches to the oblique muſcles of the belly.

3. ARTERIA THORACICA HUMERARIA.

THE THORACIC ARTERY of the ſhoulder goes off from the upper and fore part of the axillary artery. Its place is exactly oppoſite to that of the mammaria ſuperior, viz. under the point of the coracoid proceſs, inſomuch that Haller has named it thoracica acromialis. It is a ſhort, thick artery; it burſts through the interſtice between the pectoral and deltoid muſcles, and appears

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upon the ſhoulder almoſt as ſoon as it comes off from the main artery; it reſembles the thyroid in ſhape, being a ſhort thick artery, terminating all at once in a laſh of ſlender branches, which go over the ſhoulder in various directions; but I never could obſerve any order worth deſcribing. One deeper branch goes to the ſerratus major, a branch goes along the clavicle, gives it the nutritious artery, and then goes on to the pectoral muſcle, and to the ſkin of the breaſt: it gives ſmall branches to the axillary glands, and larger ones to the deltoid and pectoral muſcles and ſkin of the ſhoulder, for this is very much a cutaneous artery. The chief branch is that which is laſt named, running down betwixt the deltoid and pectoral muſcles; and the moſt curious branch is a ſmall artery which accompanies the cephalic vein, and runs backwards along the courſe of the vein, a ſmall and beautiful branch.

4. ARTERIA THORACICA ALARIS.

SOMETIMES, though not always, there is a fourth thoracic artery. When it exiſts, we find it cloſe by the laſt artery; its branches, which are ſometimes numerous, belong entirely to the cup or hollow of the axilla; it goes to the glands and fat, and thence its name of ALARIS OF AXILLARIS. This is the deepeſt or backmoſt of theſe mammary arteries; it attaches itſelf to the lower border of the ſcapula, and we often ſee it running along the lower border a conſiderable length, and giving branches chiefly to the ſub-ſcapularis muſcle.

THESE are the four mammary arteries which go to the breaſt. The arteries which go to the ſcapula follow next, and are only three in number; one, which is the counterpart of the ſupra-ſcapular artery, is the greateſt branch from the axillary artery, ſupplies the lower ſurface of the ſcapula, and thence is named SUBSCAPULAR ARTERY;

ARTERY; one, which, as it is reflected round the joint by the outſide, is named the EXTERNAL CIRCUMFLEX ARTERY; and one, which, as it turns round the inner ſide of the joint, is named the INTERNAL CIRCUMFLEX ARTERY.

5. ARTERIA SUB-SCAPULARIS.

THE SUB-SCAPULAR ARTERY is of a great ſize; it is hardly deſcribed in books, I might ſay is hardly known to anatomiſts. Douglas, and moſt eſpecially Sabbatier, have ſcarcely named it, though it is in fact one of the largeſt arteries in the body, being abſolutely as large as the axillary artery, from which it takes its riſe *.

The greateſt maſs of fleſh in almoſt any part of the body is that which lies under and around the ſcapula in a ſtrong man; and this artery ſupplies almoſt all that maſs. It goes off from the axillary oppoſite to the neck of the ſcapula, juſt under the long head of the biceps brachii: it no ſooner comes off from the axillary artery, than it attaches itſelf to the lower border of the ſcapula; and as ſoon as it comes to the edge of the ſcapula (but ſometimes lower down the edge, viz. where the head of the biceps comes off) it ſplits into two great branches; one of which goes to the upper, and one to the lower ſurface. But to deſcribe each little artery among ſuch a maſs of fleſh, or to expect to find them regular, would be very thoughtleſs; the general courſe of them only can be deſcribed. Firſt, The greater branch, which goes to the lower ſurface of the ſcapula, is the proper trunk of the ſub-ſcapular artery; it divides into two great branches, which courſe all over the lower or hollow ſurface of the ſcapula: one of theſe is deeper, runs downwards along the naked border of the ſcapula, lies

* It is named often ſcapularis inferior or infra-ſcapularis; it is better named ſub-ſcapular, both to harmonize with the name ſub-ſcapular muſcle, to which it belongs, and alſo to contraſt with its counterpart, the ſupra-ſcapular artery, which comes from the ſub-clavian artery.

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under the muſcles upon the flat bone, and ſupplies the inner ſurface of the ſubſcapular muſcle with many branches. It ſends a branch upwards, which runs along the inner ſurface of the neck of the ſcapula, runs ſtill forwards under the root of the coracoid proceſs, and its extreme branch goes round by the baſis of the ſcapula to make an inoſculation with the larger branch.

Secondly, The larger branch keeps nearer the ſurface, and ſupplies all the outer ſide of the ſub-ſcapular muſcle. Its general courſe is round the ſcapula, down the fore-edge, then round by the lower angle, then up by the line of the baſis ſcapulæ, encircling it with what might be named a coronary artery. It firſt gives branches to the teres major; then paſſes down along that muſcle to the angle of the ſcapula; then turning along the angle of the ſcapula (which it does not do without leaving many branches behind), it runs in a waving line all round the baſis ſcapulæ, till it arrives at the upper corner, where it ends in free inoſculations, both with its own deeper branch, and alſo with the ſupra-ſcapular artery which comes along the ſhoulder.

Now this great branch, with all its arteries, belongs entirely to the lower ſurface of the ſcapula; but the branch which leaves it at the neck of the ſcapula turns round under its lower edge, gets to the upper ſurface of the ſcapula, runs in under the infra-ſpinatus and teres major muſcles, betwixt them and the bone; and although the ſupra-ſcapular artery from the ſhoulder ſupplies chiefly the upper part of the ſcapula, yet it is chiefly above the ſpine that that artery circulates, while the lower parts of the infra-ſpinatus and the teres minor muſcles are left to be ſupplied by this reflected branch of the ſub-ſcapular artery: thus this reflected branch gives its arteries, firſt to the teres, then it enters into the hollow under the ſpine, and beſides ſupplying the infra-ſpinatus and the bone itſelf, it alſo makes a circle, though a ſhorter one, and inoſculates with the ſupra-ſcapularis; juſt as the other branch of this ſame artery does on its lower ſurface. This branch deſcends nearly to the corner of the ſcapula before it begins this inoſcu-

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lating circle; but it ſends alſo another chief branch round the neck of the ſcapula, which advancing towards the ſupra-ſcapular notch, inoſculates very largely with the ſupra-ſcapular artery.

Thus is the ſcapula encircled, and ſupplied with a wonderful profuſion of blood by two great arteries; one, the SUPRA-SCAPULAR ARTERY, coming acroſs the neck, over the ſhoulder, and through the ſcapular notch; another, the SUB-SCAPULAR ARTERY, which comes from the axilla to the lower flat ſurface of the ſcapula, and divides at the edge of the ſcapula into two great branches; one of which keeps ſtill to the flat ſurface, while the other turns over the edge of the ſcapula, and ſupplies in part its upper or outer ſurface.

6. ARTERIA CIRCUMFLEXA POSTERIOR.

THE POSTERIOR CIRCUMFLEX ARTERY is a very large one. It ariſes either along with, or immediately after, the great ſub-ſcapular artery; the place of it is of courſe ſettled by the place of the ſhoulder-joint, for it belongs ſo peculiarly to it that it is ſometimes named the Humeralis, ſometimes the Articularis, ſometimes the Reflexa Humeri. It goes off between the ſub-ſcapularis and teres major muſcles; it paſſes in between them to get to the joint; it then turns round the ſhoulder-bone, accompanied by the circumflex nerves, juſt as the ſupra-ſcapular artery is accompanied by the ſupra-ſcapular nerve; it ends, after having made nearly a perfect circle, upon the inner ſurface of the deltoid muſcle.

Its branches are, firſt, Twigs to the nerve which accompanies it, and to the capſule of the ſhoulder-joint.—Secondly, Branches to the coraco-brachialis and ſhort head of the biceps, and to the triceps, and a twig to that groove in which the tendon of the long head of the biceps lies.—Thirdly, It ſends large branches to the ſub-ſcapularis, to the long head of the triceps, &c.—And, laſtly, The artery, far from being exhauſted by theſe branches, goes round the bone, turns over the joint under the deltoid muſcle, and ends in a great num-

ber of branches, ſtill accompanied by branches of the nerve, which are diſtributed in part to the capſule, but chiefly to the lower ſurface of the deltoid muſcle, where it lies upon the joint.

7. ARTERIA CIRCUMFLEXA ANTERIOR.

THE ANTERIOR CIRCUMFLEX ARTERY, which goes round the fore part of the joint, bears no kind of proportion to that great artery which paſſes round the back. The anterior goes off from the ſame point nearly with the poſterior, or ſometimes ariſes from the poſterior itſelf; it takes a direction exactly oppoſite; it keeps cloſe to the ſhoulder-bone, paſſes under the heads of the coraco-brachialis and biceps; encircles the head of the os humeri juſt at the root of the capſular ligament, and goes round till it meets and inoſculates with the poſterior circumflex artery. I never could find thoſe muſcular branches which are ſaid to go to the ſcapula, or have found them very trivial; the whole artery belongs to the bone and its parts; it encircles the root of the capſule with a ſort of coronary artery; it gives twigs to the capſule, the perioſteum, and the tendons, which are implanted into the head of the bone; and having given twigs to the heads of the biceps and coraco-brachialis, it gives off its only remarkable branch, which is indeed regular and curious; it is a ſmall branch which runs down along the bone in the groove in which the tendon of the biceps lies.

CONCERNING the axillary artery in general, there is more to be obſerved than this occaſion will allow. But theſe things muſt not be paſſed over in total ſilence. In the firſt place, the artery, as it paſſes over the border of the cheſt, and after leaving the arch of the clavicle, is felt beating, and there it can be compreſſed.

The compreſſing of the ſubclavian artery with a tourniquet or with the thumb, attracted at one time ſo

much attention, and incited ſo many to ſpeak about it, that it came to be thought important, and has been ever ſince eſteemed practicable; and yet even thoſe who have ſpoken the moſt confidently have taken the thing merely upon vague report, have neglected to read the proper books, have deſcribed the way of compreſſing as above the clavicle, not knowing that it ſhould be done below it. Camper, in his "Fabrica Brachii Humani," firſt mentioned what he had demonſtrated in his claſs, viz. that he could, by placing the thumb under the point of the coracoid proceſs, ſo compreſs the axillary artery againſt the ſecond rib where it lies upon it, that even the ſtrength of a ſyringe could not puſh an injection through it *. And thoſe who learn things by hearſay, have ſaid that "the ſubclavian artery could be compreſſed by thruſting the thumb in above the clavicle;" although in fact, the arch is ſo deep, the muſcles ſo ſtrong, and the artery ſo little expoſed, that this is abſolutely impoſſible.

From my ſpeaking with a ſeeming intereſt about the preference of one of theſe two places to the other, it may be thought that I believe this piece of knowledge uſeful: Quite the reverſe! I know it to be dangerous; I know it to be leſs practicable than authors report and believe; and I repeat what I ſaid on a former occaſion, that "it is eaſy to ſtop the pulſe of an artery, but quite another matter to ſtop the flow of blood through it." We thruſt down our hands and compreſſes, and reſt with our whole weight upon the artery; it ſeems

* In cadaveribus plus ſemel in publico theatro monſtravi, comprimi poſſe integram arteriam; ligabam arteriam aortam infra arcum, reſecabam deinde axillarem dextram, ac ſiphone axillari ſiniſtræ adaptata fortiter aquam impellens, ſolo digito eo modo moderare potui ſubclaviam, ut ne gutta quidem efflueret: quod quanti momenti eſſe queat in amputatione humeri in articulo nemo non videt. In vulneribus ſclopetariis, aliiſque circa humeri articulum inflictis, ſanguinis profuſionem ſimiliter compeſcere, ſi non penitus ſiſtere poſſemus. Vid. *Camper*, lib. i. p. 15.—The plain reaſon why we are able thus to compreſs the artery in the dead ſubject is the want of reſiſtance in all the muſcles. If ever it be poſſible in the living body, it muſt be when the ſtrength is low, and the circulation very languid, after the patient has fainted with loſs of blood.

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ſtopped, becauſe the pulſe is ſtopped; but the firſt ſtroke of the knife ſhows us how far we are gone in a dangerous miſtake. I may ſay, without breach of confidence, that I have ſeen one gentleman truſt to it, who will never trouble himſelf about it again. He was a dexterous ſurgeon; and in a great aneuriſm of the axilla was deluged with blood at the firſt ſtroke of the knife, and ſaved his patient only by a plunge of the great needle.

Secondly, It is much to be lamented that we cannot really ſuppreſs the blood; not merely becauſe it would make every wound leſs dangerous, but becauſe it would greatly facilitate operations which we are called upon every day to perform. Would it not be pleaſant if we could cut the cancerous breaſt without the loſs of blood? or ſearch into the axilla with perfect deliberation, and cut diſeaſed parts out with the knife, not tearing them in a brutal manner with our fingers? Yet ſtill, by ſtudying this piece of anatomy, the ſurgeon knows both from what ſource all the arteries which bleed upon the ſurface of the amputated breaſt come, viz. the long mammary artery; and alſo that in any very dangerous ſituation it would be eaſy to command all the bleeding orifices by one dip of the needle, the axilla being open. He alſo knows that the thoracica alaris and the ſhort thoracic artery ſupply all the glands, and that theſe lurk too deep in the axilla to be ſecured otherwiſe than by a compreſs: ſo that theſe arteries are in fact opened by tearing with the fingers, and are ſtopped by thruſting in a ſpunge. He knows alſo how many large arteries there are, eſpecially about the ſcapula, of which the bleeding muſt reſemble that of the axillary artery itſelf; he will judge of the nature of the wound by the pulſe; and he will act with great advantage in all doubtful caſes, by remembering theſe great arteries of the ſcapula, which either bleed outwardly moſt furiouſly, or if they ſeem to ſtop, it is only by filling the axilla with blood.

Thirdly, The connection of the artery with the axillary nerves, though it muſt be more fully deſcribed in another place, muſt yet be obſerved here as a relation

too important to be omitted. The artery paſſes along with the nerves through the interſtice of the ſcaleni muſcles; the nerves, which conſiſt of no leſs than ſeven pairs, make by their mutual connections a ſort of net, which is called the plexus of the axillary nerves. This plexus has its meſhes formed, not by ſmall diviſions, but chiefly by the ſeven great cords. This broad plexus lies over the artery as it comes out from the cheſt; the artery perforates the plexus, or paſſes through one of the largeſt meſhes in the cavity of the axilla; and when we extend the arm, for example, to cut out an axillary gland, the great veins lie neareſt the knife, or loweſt in the axilla; the plexus of nerves next; and laſt of all the artery which has juſt perforated the plexus of theſe great nervous cords; three nerves are below the artery and two above; and when the arm is luxated, and the ſhoulder-bone puſhed downwards, the head of it is ſo preſſed againſt the net of nerves, and the artery is ſo compreſſed betwixt the head of the bone and the meſh of nerves, that I have very ſeldom failed to find the pulſe almoſt entirely ſuppreſſed in luxations of this kind.

This connection, viz. with the nerves, is a very intereſting one. It is plainly ſuch that the artery cannot be hurt without a wound of the nerves; it has never been known that the artery has been cut in the axilla without the arm being lamed by this wound of the nerves: alſo the nerves cannot be hurt without the artery being in danger; but it does eſcape ſometimes; of which, among other examples, this is one of the moſt ſingular.—I have ſeen the artery eſcape in wounds when the nerves were hurt; but how it could eſcape the ſtroke of a blockhead's needle in the following caſe, I am at a loſs to conceive. A woman came to me with a great ſtring hanging in her axilla, and along with her came her ſurgeon. He had about three months before cut off her breaſt for a cancer, and moreover ſome glands from the axilla, from which there was a bleeding; and of courſe, as his fingers could not go deep enough, he took a needle proportionably large, ſtruck

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it down into the arm-pit, and tied all up. When he brought his patient to me, there hung from the arm-pit, not a ſurgical ligature, but a good large tape; the axilla was a large gaping and terribly fetid ulcer; I paſſed my finger into it, and felt the arteries beating around it, and the tape firm about ſome cord of nerves, whether one or more I could not tell; the Woman's fingers were as crooked as a bird's talon, and her arm hung by her ſide quite uſeleſs and lame. I made the ſurgeon feel the nerve with his finger, and offered to cut out the ligature ſafely; but he carried away his patient, that he might, though at a long interval, finiſh the operation himſelf.

The breaſt had been long healed, and the cord acted as an iſſue in the axilla. How near the edges of this needle muſt have been to the great artery, it is terrible to think; and it is moſt providential that ſuch accidents do not happen daily, conſidering how much this crooked needle is uſed in deep places, where it is leaſt fit to be uſed.

III. OF THE BRACHIAL ARTERY.

THE brachial artery is that diviſion of the artery which is marked by the tendon of the great pectoral muſcle: for as that is the fore border of the axilla, all above that is axillary, and all below it brachial artery, down to the bend of the arm, where it divides into the radial and ulnar arteries. The brachial artery runs on the inner ſide of the os humeri, here the bone is moſt naked; and this is the line in which we feel the artery beating, and apply the cuſhion of the tourniquet.

To deſcribe, as ſome authors have done, each inſignificant and nameleſs branch which this artery gives off, were to make a ſimple matter intricate beyond all enduring. The whole matter is this: As the artery goes downwards, lying exactly on the inner ſide of the arm bone, and directly in the middle betwixt the biceps on the fore part and the triceps behind, it gives frequent branches to each. Thoſe going to the biceps are ſhort,

 ſmall,

ſmall, pretty regular, and exceedingly like each other all the way down the arm; and they are thus frequent, and very ſhort, in conſequence of the artery adhering cloſer to the ſides of the biceps. Not one of them can be diſtinguiſhed, or is worth naming. Thoſe which it ſends downwards to the triceps are (in conſequence of that being a large muſcle, with ſeveral thick and fleſhy origins) both longer and more tortuous, and more important; and they accordingly have ſome of them appropriated names. Of theſe arteries going down towards the back part of the arm, and working their way among the muſcles, three chiefly are to be obſerved. Firſt, The arteria profunda ſuperior, which goes round the back of the arm to the exterior muſcles, and is often named the upper muſcular artery. Secondly, Another like it, called arteria profunda inferior, or the lower muſcular artery. Thirdly, The ramus anaſtomoticus major, which anaſtomoſes round the elbow with the branches of the ulnar artery. Theſe three chiefly deſerve notice.

1. ARTERIA PROFUNDA HUMERI SUPERIOR.

THOSE arteries, which in the limbs go deep among the fleſhy parts, as in the arm or thigh, have always one of two names, either profunda or muſcularis, and often both. The upper deep muſcular artery of the arm is about the ſize of a crow-quill, or larger; it goes off from the inner ſide of the brachial artery, juſt where the tendons of the latiſſimus dorſi and teres are inſerted: and very often it ariſes from the great artery of the ſcapula, or that of the joint, viz. the ſub-ſcapularis, or reflexa humeri.

The PROFUNDA turns downwards and backwards round the bone; it glides in betwixt the firſt and ſecond head of the triceps; there it divides within the thick fleſh of that muſcle into two chief branches, or the two branches ſometimes part immediately after their common origin, or ſometimes they go off apart from the humeral artery. One of theſe, perforating the biceps muſcle, turns

turns quite round the bone; and Monro the Father, who gave us the name of ſpiral nerve, named this alſo, very properly, the muſcular ſpiral artery: ſo this artery alſo, as well as the ſupra-ſcapular and circumflex arteries, has its accompanying nerve. This long artery runs down the back and outſide of the arm; it deſcends quite to the outer condyle of the os humeri, and by branches round the olecranon, and over the outer condyle, it inoſculates very freely with the radial artery.

The other branch of the profunda ſuperior runs down the inner ſide of the arm, gives many branches to the triceps, and coraco-brachialis; gives a few alſo to the biceps and deltoid muſcle: its longeſt branch, the proper termination of the artery, runs downwards till it touches the inner condyle, as the poſterior branch does the outer condyle; and this inner artery communicates with the outer branch round the olecranon, making ſmall but frequent and beautiful inoſculations; and it alſo inoſculates over the condyle with the reflected branch of the ulnar artery. In ſhort, the profunda ſuperior turns down towards the back part of the arm, buries itſelf under the triceps muſcle, ſupplies all the fleſh of the triceps, and divides in the heart of that muſcle into two branches, both of which go down to the elbow-joint, and inoſculate; the one, round the outer condyle with the radial artery; the other, round the inner condyle with the ulnar artery.

2. ARTERIA PROFUNDA HUMERI INFERIOR VEL MINOR.

THE LESSER PROFUNDA, or the lower muſcular artery, is ſo named becauſe it reſembles the former in almoſt all points. It is ſmaller, being not half the ſize (viz. of a crow-quill), and goes off, in general, about two inches lower down the arm. Its courſe, alſo, is exactly ſimilar, except in this, that it is ſingle, does not divide into two branches; it gives twigs to the muſcles of the arm; runs down to the inner condyle, and after

after touching it, makes a ſudden and ſerpentine turn, by which it gets upon the back part of the elbow-joint. Its chief inoſculations are with the upper profunda, and with the recurrens interoſſea upon the back part of the joint.

Betwixt the upper and lower profunda there generally is ſent off that artery which is to nouriſh the bone. It is named ARTERIA NUTRITIA HUMERI; but is not of ſufficient importance to be numbered among the main branches of the artery. The nutritious artery ſends off ſmall branches, or rather ſmall twigs, to the brachialis, or that muſcle which lies under the biceps and to the triceps; and it perforates the bone about its middle in one larger artery, and ſometimes there are alſo one or two ſmaller ones.

3. RAMUS ANASTOMOTICUS MAJOR.

THE GREATER ANASTOMOSING ARTERY is one of three or four which anaſtomoſe round the elbow-joint: for as the humeral artery advances towards the bend of the arm, it begins about three inches above it, to give off ſidewiſe, and almoſt at right angles with the trunk, three or four ſmall arteries, more or fewer according to the ſize of the arm. Each of theſe ſends its little twigs round the condyle, to inoſculate with the arteries of the fore-arm both radial and ulnar. Among theſe one is diſtinguiſhed for its ſize and importance; it is one of the largeſt of theſe arteries, and thence named ANASTOMOTICUS MAGNUS; it ariſes from the Humeral artery about three inches above the joint; it lies cloſe by the ſide of the brachialis internus, and gives many branches to it and to the triceps; but it is chiefly expended in three branches, one of which turns backwards, and running up the arm gives branches to the muſcles, and inoſculates with the profunda: another goes downwards towards the middle of the bend of the arm, and gives branches to the pronator teres and the flexor digitorum; and then going deeper, it touches the capſule, and makes a beautiful inoſculation over the fore-part of the joint with

with the radial recurrent or inofculating artery: another branch, the moft important, and the chief termination of the artery, runs down betwixt the olecranon and the condyle, in the hollow where the ulnar nerve lies. It firft contributes to that net-work of inofculations which covers the back of the joint over the olecranon; it inofculates very freely with the recurrens ulnaris; and it is this inofculation that gives the artery its importance and its name. This is the channel through which the blood goes after the operation for the aneurifm, as we know from preparations; and I have feveral times felt for it, and found it after the operation, while the arm was ftill very fmall, having been wafted by the difeafe and by the fuppuration.

I have not, in defcribing thefe arteries of the arm, once mentioned the name of collateral artery; for it is a name which muft be entirely dropped, becaufe it has been much abufed. Sabbatier, Murray, Haller, and all the French and German anatomifts, have named the arteriæ profundæ COLLATERAL ARTERIES; becaufe they lie alongfide of the great artery, running along with it down the arm. Douglas, and the Englifh anatomifts and furgeons, have called the three or four fhort anaftomofing branches near the elbow the collateral arteries; becaufe, though they run off at right angles or obliquely from the trunk, yet they run parallel with each other. Dropping this name, then, we find no more than three arteries in the arm of any note: the upper or greater profunda, with its two branches; the lower or leffer profunda; and the great anaftomofing artery.

OF THE ARTERIES OF THE FORE-ARM, VIZ. OF THE RADIAL, ULNAR, AND INTEROSSEOUS ARTERY.

THE place and condition of this artery at the bend of the arm is as interefting as where it lies in the axilla; for while bleeding is allowed, or is practifed by low and ignorant people, operations at this point muft be more frequent

frequent than at any other, and muſt be eaſy or ſucceſsful only in proportion as the artery and all its relations is well underſtood.

The humeral artery ſtill continues an undivided trunk, much lower than the bend of the arm; though we are accuſtomed to name that as the place at which it divides. The whole arm, it muſt be remembered, is covered with a faſcia, and that faſcia lies over the artery; but at the bend of the arm there is a peculiar faſcia, or at leaſt the round tendon of the biceps ſo ſtrengthens the general faſcia, by ſending a broad expanſion obliquely acroſs the bend of the arm (which faſcia is fixed into the condyle and down the edge of the ulna), that we call this expanſion peculiarly the tendon of the biceps, and ſay that the artery is at the bend of the arm covered and protected by the tendon of the biceps muſcle. The condition then of the artery is ſhortly this: It comes from the inſide of the arm, inclining all along towards the middle of the bend or folding of the fore-arm; there, without any particular ring or aperture for its admiſſion, it paſſes under the aponeuroſis of the biceps muſcle; for the aponeuroſis of the biceps and of the arm in general are one continued ſheath. When thus lodged behind the tendon, it lies in a deep hollow betwixt the flexors and extenſors of the arm, or, in other words, betwixt the muſcles of the upper and of the lower edge; the tendon of the biceps covers this triangular hollow; the floor or bottom of it is the coronary proceſs of the ulna and the forepart of the elbow-joint, and there the artery lies imbedded in cellular ſubſtance, encircled by thoſe veins which accompany the artery particularly, and which are thence named venæ comites; and it carries along with it a nerve in diameter equal to itſelf, and this nerve is named the great radial nerve.

The artery does not divide immediately, even after it has thus paſſed the bend of the arm, but goes down deep among the fleſh of the fore-arm, and there divides; the ulnar artery being lodged under the thick fleſh of the pronator and flexor ſublimis muſcles, and the radial artery under the ſtrong fleſhy belly of the flexor radialis

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and of the ſupinators, not abſolutely within their ſubſtance, but under cover of their fleſhy bellies, which ſwell out into a great thickneſs at this part of the arm. The only part of the artery which is expoſed, the point which we feel beating, is that where the ſingle and undivided trunk firſt begins to paſs under the thicker faſcia of the biceps muſcle; and there the artery is puſhed forwards, raiſed, and made to appear ſuperficial by the projection of the coronoid proceſs and brachialis muſcle, or, properly ſpeaking, by the protruſion of the forepart of the elbow-joint. This is juſt before it ſinks into the triangular hollow betwixt the muſcles.

This artery is ſingular in one kind of luſus naturæ, which never happens, nor any thing ſimilar to it, in the lower extremity, viz. that the trunk of the artery forks into two great branches high in the arm; ſometimes in the axilla, but oftener in the middle of the arm, or oppoſite to the pectoral muſcle: and I have conſtantly obſerved, when this happened, that the radial artery was, as it were, the accidental branch, and paſſed acroſs the arm near the bend of the elbow, ſo as to traverſe the ulnar or main artery; and that the radial artery paſſes quite on the outſide of the faſcia, which binds down the ulnar or main branch of the artery.

This ſhort deſcription involves many points which the ſurgeon ſhould think of, and more than can be touched upon in this place. The following conſequences certainly follow from this arrangement of parts.

Firſt, The artery lying thus deep under the biceps, cannot be hurt by any ſkilful ſurgeon, though bleeding the very vein under which it beats, and at the moſt critical point; it is hurt, as far as I have obſerved, only by the rudeſt ſtroke of very ignorant fellows; I have ſeen in ſix caſes a wound in it little leſs than a quarter of an inch in length. In one of the operations I found it abſolutely transfixed; the blood had been poured out from the orifice behind; I felt with ſurpriſe the artery running over the tumor, not under it; and having opened the ſac, I paſſed a probe through the artery from ſide to ſide.

Secondly, Since the artery divides only after it has gone

gone deep, where its great branches are protected by the muſcles of the fore-arm, the trunk only is wounded in bleeding; the branch is never wounded; and we cannot but be ſurpriſed that Hunter, Haller, Sharp, and others, who ought to have ſtudied this point, believed it to be ſometimes at leaſt wounded in one of its branches; nor can we think, without ſurpriſe, of the arteries being ſo little underſtood in the time of Dr. Monro the Father, that he is forced to argue the propriety of doing the operation of aneuriſm from this fact, "That though it were dangerous to truſt to the common anaſtomoſis round the elbow, yet it ſometimes happens, that the two branches of the radial and ulnar are ſet off in the axilla." This ſurely muſt have been but a cold aſſurance to the ſurgeon in thoſe days, viz. that he was to truſt chiefly to the chance of a luſus naturæ for the ſucceſs of one of his greateſt operations.

Thirdly, It muſt follow, ſince the artery lies behind the faſcia, and is wounded through it, that the blood, being poured out behind the faſcia, muſt raiſe it into a hard, firm, and (in time) inelaſtic tumour, growing every day firmer and harder. If ſurgeons will but think of this, they will go through their operation more correctly. It makes a point of vaſt importance in the deſcription of aneuriſm, ſince it gives outwardly the true character, and inwardly the true ſhape and appearance of the tumour, when the operation is begun, the outward inciſion being performed. Had it been but attended to rightly, what noiſe and wrangling might it not have ſaved about the nature and names of the diſeaſe (yet ſtill the older ſurgeons knew and deſcribed this piece of anatomy, though they made but a poor uſe of it)? and what idle and ſtupid deſcriptions might it not have prevented, ſuch as we have never ſeen in ſurgical books till now, of diffuſed aneuriſm, and the operation for diffuſed aneuriſm; when in truth the firſt ſtroke of the knife ſhows it to be a tumour very different from that which ſuch names, and ſuch formal diviſions, and old faſhioned deſcriptions muſt convey? The cup of an aneuriſm is the triangular hollow which I have deſcribed,

ſcribed, and the bag of the tumour is the extended faſcia.

Fourthly, The courſe of this double artery tempts me to believe, that in thoſe few caſes where the blood of an aneuriſm was truly diffuſed, where it was an ecchymoſis, where the blood was not confined by the faſcia, but poured out under the ſkin, and driven upwards to the ſhoulder, and downwards to the fingers, giving the whole arm the appearance of mortification; that in ſuch rare caſes, there muſt have been a high diviſion, and that the preternatural artery had been wounded, for it lies above the faſcia, it is lodged in no hollow, ſuch as might receive its blood, nor covered by any membrane which might confine it: but at all events, I am perſuaded that Hunter is wrong in ſuſpecting that, ſince the pulſe ſo ſeldom returns inſtantly, this preternatural artery and the true one muſt be often tied together; for if the preternatural artery were wounded, it would be a very diffuſed aneuriſm, under the ſkin and above the faſcia; but the main artery would be found in its place, under the faſcia, quite ſafe; whereas, if the true artery were wounded, the tumour would be under the true faſcia, the preternatural artery would croſs by the ſide of the tumour, or over it, and the wounded artery being at the bottom of its own tumour, the two arteries would be ſix inches apart. Beſides, the neceſſity of ſuppoſing this is not ſo ſtrong as Hunter believed; I have ſeen the pulſe return during the dreſſing of the arm, when the diſſection was ſo wide and free that I am ſure there could be no luſus naturæ, but one artery dividing in the common place.

Fifthly, The cloſe connection of the artery with the great radial nerve muſt always be conſidered in all wounds at the bend of the arm; and eſpecially it conſtitutes a difficulty in the operation of aneuriſm, of which authors of great eminence have ſpoken far too lightly; and ſurgeons of character have tied it in with their great ligatures, as if for amuſement, or that they might ſee what would enſue. But, as I have ſaid on another

another occaſion, "a man muſt ſhow me either ſome poſitive neceſſity for doing this, or ſome poſitive good conſequences which will reſult from it, before I admit him to argue about the bad effects which may enſue." Will any man perſuade me, after the caſe which I have juſt related, that it is good or harmleſs to tie in the largeſt nerve of the arm? We ſee by that caſe, that the ligature's remaining firm in its place for three months is one of the leaſt of the ill conſequences, and the others may eaſily be conceived. Of theſe ill conſequences I have ſeen more than I will venture to tell.

The humeral artery having left this moſt critical point at the bending of the arm, divides into three great branches, the radial, ulnar, and interoſſeous arteries; at leaſt the ulnar gives off the interoſſeous ſo ſoon, and the interoſſeous is ſo large, and has ſo pointed a deſtination, that I take the privilege of deſcribing the three branches apart. The ULNAR ARTERY, which we muſt regard as the continuation of the main artery, makes its way through the thickeſt fleſh of the fore-arm, goes along the ulnar edge of the arm, appears again from under the muſcle, about three or four inches above the wriſt; it goes down to the root of the little finger, and gives the chief arches in the palm of the hand, and all the arteries of the fingers, ſaving only the inner ſide of the fore finger. The radial artery goes off like a branch from the ulnar, or, in other words, the ulnar ſeems to continue in the courſe of the main artery, while the radial goes off to one ſide; it makes its appearance as a ſuperficial artery much higher in the fore-arm than the ulnar does; it turns backwards over the wriſt, or root of the thumb, and it gives all the arteries of the thumb and forefinger, as the ulnar does of the other fingers. The interoſſeous, again, is truly a branch from the ulnar; it comes off where the ulnar lies deepeſt; it runs along the interoſſeous membrane, whence its name; it

belongs to the deep muſcles of the arm; it ſcarcely paſſes the wriſt, or at leaſt mounts but a very little way along the back of the hand.

Theſe are the great diviſions of the artery; but before entering upon theſe, it will be well to ſet apart and deſcribe one particular ſet of arteries, viz. the recurrents; both becauſe they belong in a peculiar manner to the joint, and becauſe the recurrents, from which-ſoever of the great arteries they come, ſtill ſerve the ſame office, viz. of inoſculating with thoſe from the above joint; though, after all, this part of their office attracts our attention, chiefly becauſe we depend upon theſe inoſculations for our ſucceſs in operations for aneuriſm, though unqueſtionably the chief uſe of theſe arteries is to ſupply the joint and adjacent parts; and their inoſculations are but a ſecondary office.

ARTERIÆ RECURRENTES.

THE recurrent arteries are ſmall arteries correſponding with the anaſtomoſing arteries from above. They turn quickly backwards almoſt as ſoon as they are clear of the main arteries from which they ariſe: they encircle the whole joint, for they are no leſs than four, or ſometimes five in number; one from the radial, two from the ulnar, and one from the interoſſeous artery.

RECURRENS RADIALIS ANTERIOR.

THE ANTERIOR RECURRENT of the RADIAL artery is the firſt branch which it ſends off, excepting a ſmall branch to the ſupinator and ſkin. The place where the radial recurrent is to be found, is deep in the hollow betwixt the brachialis internus or muſcle of the arm, and the extenſor radialis or firſt muſcle of the fore-arm, viz. that which conſtitutes its outer edge. The recurrent lies upon the fore-part of the joint, where the outer condyle is: the muſcles which lie over this recurrent artery, or near it, are the two flexors of the wriſt, the ſupinator longus, and the biceps, and theſe receive its firſt branches; and one of its branches runs down along the

the tendon of the ſupinator. Its next branches go leſs regularly to the other muſcles of the fore-arm, as to the pronator teres, and to the flexors of the fingers; it has one SUPERFICIAL ANASTOMOSING artery, whoſe anaſtomoſes are not upon the naked joint; but, on the contrary, the branch mounts along the fore-part of the brachialis internus muſcle, and inoſculates under the biceps with the leſſer or lower profunda. A ſecond anaſtomoſing branch goes deeper; it paſſes through the fleſh or belly of the brachialis, and anaſtomoſes with the ramus anaſtomoticus major from above. A third anaſtomoſing branch is the chief branch; it lies deeper ſtill upon the fore-part of the joint, in the hollow which I have lately mentioned: it runs up under the belly of the ſupinator, along the fore-part of the ſhoulder-bone, where it inoſculates with the upper profunda humeri, and chiefly with its greater branch called ſpiral artery; which turns round the bone, and ends here over the outer condyle.

This is the recurrens anterior of the radial artery; but none of theſe branches have I ever ſeen or felt to be enlarged after operations for aneuriſm. The ſucceſs of that operation depends entirely upon the arteries next to be deſcribed, viz. the ulnar recurrents, which are always two in number; but ſometimes theſe two recurrents go off in one branch from the ulnar: in which caſe, viz. of a ſingle recurrent coming off from the ulnar, it divides immediately into two branches, and the one takes the fore and the other the back part of the joint.

RECURRENS ULNARIS ANTERIOR.

THE ANTERIOR RECURRENT of the ULNAR artery goes off the firſt of the branches, immediately before it gives off the interoſſeous, and where the artery lies deep in its triangular hollow. This anterior artery paſſes up under cover of the pronator teres, lies cloſe upon the fore-part of the inner condyle, and is of importance, not only by its own ſize, but alſo by its anaſtomoſing with the

the ramus anaſtomoticus major, which is the largeſt of the arteries from above.

RECURRENS ULNARIS POSTERIOR.

THE POSTERIOR RECURRENT of the ULNAR artery often a branch of the anterior one, coming off with it in one common trunk. When it comes off apart, it ariſes a little lower; it is a larger and ſtronger artery, i. e. it makes as full inoſculations, goes farther, and gives more branches to the muſcles. This poſterior recurrent ariſes from the ulnar at that place where it perforates the bellies of the flexor muſcles; it alſo dives through betwixt the two bellies of the flexor muſcles of the fingers, it thus gets round the condyle, for theſe two muſcles ariſe together, from the condyle: the artery gives many branches both to the pronator and flexor muſcles, and to the perioſteum, and capſule of the joint; it then lodges itſelf in that deep hollow which is betwixt the olecranon and the condyle, where the ulnar nerve lies (that nerve which we feel ſo benumbed when we ſtrike the inner ſide of the elbow). The artery, ſtretching upwards along the bone, meets a ſimilar deſcending branch from the upper profunda, and inoſculates with it. As far as we yet know, the whole weight of the buſineſs in ſaving the arm after aneuriſms depends upon theſe two arteries. In Mr. White's preparation it is the anterior branch which is enlarged, inoſculating with the anaſtomoticus major over the fore-part of the inner condyle. In a preparation which I have, it is the poſterior artery which runs tortuous and enlarged behind the inner condyle: but I muſt add to the authenticity of this preparation, by noticing, that I have ſeveral times felt diſtinctly, after ſucceſsful operations for the aneuriſm, that it was this poſterior artery that was enlarged.

RECURRENS INTEROSSEA.

THE RECURRENT of the INTEROSSEOUS artery is the firſt of its branches, though ſometimes this recurrent

riſes from the ulnar a little above the interoſſeous. This artery going to the middle and back part of the joint is very conſtant; it firſt ſends one ſmaller branch forwards towards the root of the brachialis internus muſcle, which inoſculates over the fore-part of the joint with the ramus anaſtomoticus magnus, and with the ulnar and the radial recurrents; but theſe inoſculations and this anterior branch are of ſmall importance. The chief branch goes through that lacerated-like hole which is in the upper end of the interoſſeous ligament; and the artery having paſſed through this hole, and got to the back of the joint, it runs for two inches upwards along the back of the olecranon, contributing greatly to form, by its inoſculations with both branches of the profunda ſuperior, that net-work of arteries which covers all the back-part of the joint, and which belongs chiefly to the joint, to the capſule, and to the bones which form the joint.

From theſe anaſtomoſing branches which belong to all the three arteries, we now return to deſcribe the general courſe of the three great arteries; and firſt of the radial.

ARTERIA RADIALIS.

THE RADIAL ARTERY is properly the firſt branch of the ulnar; it goes off from it at a pretty obtuſe angle in the bend of the arm; it paſſes under the pronator muſcle, emerges from under it above the middle of the arm, follows the long tendon of the ſupinator, and runs under it down to the root of the thumb; it is at the root of the thumb only that it divides into its great branches: and a clear proof that in its courſe down the fore-arm it gives off none but ſmall and irregular muſcular branches, is this, that it preſerves almoſt an equal diameter in all its progreſs from the elbow to the wriſt.

This is the artery which lies naked upon the radius at the wriſt, where we feel the pulſe. It lies more ſuperficial, leſs imbedded in muſcles, than the ulnar artery; for ſix inches above the wriſt there is to be felt

 nothing

nothing but the naked artery, the ſharp tendon of the ſupinator, and the bone. The radial artery, as to its courſe down towards the wriſt, is direct; but with regard to itſelf, it is tortuous, with ſhort and gentle wavings. Of its branches, as it moves down the fore-arm, there is not one that is worthy to be named. Firſt, it gives a branch to the ſupinator, and to the extenſors of the carpus; then it gives the radial recurrent, already deſcribed; then, having gone a little deeper among the muſcles, it repeats its branches to the ſupinator and extenſors; but being deep, it gives alſo twigs to the pronator and to the flexor radialis, inoſculating with the interoſſeous arteries. Next the radial artery, emerging from among the thickeſt of the muſcles of the fore-arm, becomes ſuperficial, touches the naked radius, and runs along it, with the belly of the flexor pollicis below it and the long tendon of the ſupinator above it. Here are no muſcles lying on the outſide of it, nothing but the tendon; and therefore all its twigs are downwards to the flexor pollicis, upon which it lies; to the flexor digitorum, which lies next to that; and to the flexor radialis and the palmaris longus. Next it gives deeper branches, viz. to the pronator quadratus; and alſo it gives ſmall twigs, which accompany the ſeveral tendons along the naked bone. Arrived at the wriſt, it does not divide, as authors have repreſented, into two branches, viz. a palmar and a dorſal artery; this is indeed a very rare occurrence: the radial artery paſſes on undivided to the root of the thumb, and there divides into three great branches; one to the thumb, one to the fore finger, and one to the palm of the hand: it does indeed, while it is paſſing the wriſt, give two conſiderable branches, one to the palm, and one to the back of the hand; yet they are but branches.

ARTERIA SUPERFICIALIS VOLÆ.

The firſt branch, then, of the radial artery, after arriving at the wriſt, is that which goes acroſs the palm of the hand, and may be named the SUPERFICIAL artery

tery of the PALM. It goes off juſt where the main artery is about to turn over to the back of the hand; it paſſes in general through the fleſh of the thumb, going under the root of the ABDUCTOR BREVIS POLLICIS. This artery we generally find dividing into three branches: The firſt is a more ſuperficial branch, which croſſes the palm of the hand, and gives its twigs to the ſkin, palmar aponeurosis, annular ligament, and all the tendinous parts about the joint: The ſecond is a larger and more important branch; it is the middle branch of theſe three; it goes deep; and having given ſeveral branches to the muſcles about the root of the thumb, and to one or two of the interoſſei muſcles, it makes a large inoſculation with the great palmar arch, which ſeems to be indeed the chief tendency of the whole artery: The third branch is leſs regular than the others; it mounts along the root of the thumb, and belongs to its outer edge*.

The next branches of the radial artery are very ſmall and nameleſs twigs, which go to the naked part of the wriſt, to the tendons, ligaments, and the bones; and then comes the artery oppoſite to this artery of the palm, viz. the artery of the back of the hand.

ARTERIA DORSALIS CARPI.

THE ARTERY of the BACK of the HAND comes off from the radial, juſt after it has turned over the radial edge of the wriſt. It takes its courſe directly acroſs the back of the hand, over the carpal bones; and by its frequent inoſculations with branches from the ulnar artery, and with the dorſalis metacarpi or dorſalis manus, it makes beautiful net-works acroſs all the naked part of the back of the hand.

* This branch anatomiſts have thought fit to call ARTERIA ULNARIS RADIALIS POLLICIS, which involves ſuch a complication of contradictions, that, upon reading it, one would naturally turn to the table of errata. The artery is called radialis, becauſe it comes from the radial artery; and ulnaris pollicis, becauſe it goes upon the ulnar ſide of the thumb.

DORSALIS

DORSALIS METACARPI.

The radial artery, continuing its courſe under the extenſor tendons of the thumb, ſends off the dorſalis metacarpi, which is an artery generally larger than the laſt; it takes its courſe acroſs the back of the hand and over the metacarpal bones, and from this artery are given off the interoſſeous arteries.

The firſt interoſſeous artery of the hand is large, long, goes up in a direct courſe to the fork betwixt the fore and mid fingers, and plunges into the cleft of the digital artery at right angles with it. A ſecond twig like this, and then a third are given off; named the firſt, ſecond, and third interoſſeous arteries: but they are all ſmaller than the firſt, and all the three communicate with the arteries from the palm.

Before the final diviſion of the radial artery * into its three branches, it gives a third artery, or, as often happens, two arteries, to the back of the thumb.

ARTERIA DORSALIS POLLICIS.

The ſmall artery, or the two ſmall arteries which, from going along the back of the thumb, are named arteriæ dorſales pollicis, come off either along with, or immediately after, the dorſalis carpi. When there are two, they run both along the back of the thumb, one on one ſide, the other on the oppoſite ſide; that which runs along the outer edge of the thumb paſſes through under the tendons, and is rather ſhorter; that which inclines to the inner ſide of the thumb is rather longer. Theſe ſmall arteries on the back inoſculate round the edges of the thumb with the great artery on the inner ſide; which is next to be deſcribed.

Thus we have ſeen that the radial artery, having ad-

* Notwithſtanding the inconſiſtency of retaining the name of radial artery, after the artery has paſſed the wriſt, and begun to run along the thumb, I venture to ſacrifice verbal accuracy, and would make much greater ſacrifices to obtain a clear arrangement.

vanced to the wriſt, turns quick round the wriſt, over the head of the radius, and under the tendons of the thumb; it gives immediately before it paſſes, the artery of the palm; it gives immediately after it paſſes, the artery of the back of the wriſt; it gives immediately after that the artery to the back of the hand; and then the little arteries for the back of the thumb; it then mounts along the thumb in that hollow which is by the ſide of the metacarpal bone of the thumb, till it arrives at the cleft betwixt the thumb and fore-finger. Here it divides into three arteries; one to the inner ſide of the thumb, very large; another to that ſide of the fore-finger which is next the thumb, which branch is much ſmaller; and one which exceeds theſe in importance, for it dives down into the palm of the hand, forms what is called the deep arch of the palm; and which, having croſſed the palm, forms on the ſide next the little finger that inoſculation betwixt the upper and lower arches which is ſo much celebrated.

ARTERIA RADIALIS INDICIS.

THE artery of the fore-finger proceeding from the radial artery is the firſt and ſmalleſt of theſe three branches. It goes off at the root of the metacarpal bone of the fore-finger, goes up along its interoſſeous muſcle, and runs along all the edge of the fore-finger next the thumb, inoſculating with the artery of the oppoſite edge, which comes from the ulnar arch; it ſends off twigs at its root, which inoſculate with the ſmall dorſal arteries of the thumb; and it gives a branch to the adductor indicis.

ARTERIA MAGNA POLLICIS.

THE CHIEF ARTERY of the THUMB riſes along its metacarpal bone, a ſingle artery, and there ſplits commonly, I think, into three ſmaller branches. Two of theſe run along the fore-part of the thumb up to its extremity, and inoſculate there; the one running along the

the radial, the other along the ulnar ſide, till they meet at the point. Theſe are, as it were, counterparts of the dorſal arteries, but greatly larger, the thumb being naked on the back, but fleſhy where it looks towards the palm. Another branch of the arteria pollicis is one which turns to the palm of the hand, and runs towards the fore-finger.

ARTERIA PALMARIS PROFUNDA.

THE third branch of the radial artery, and that by which it ends, immediately ſucceeds the artery of the thumb. It croſſes the palm of the hand ſo as to form the deep arterial arch, or the radial arch of the palm; it lies under the aponeuroſis, and all the tendons and muſcles cloſe upon the metacarpal bones. Having gone its circle ſo as to complete the arch, and having arrived at the root of the little finger, or rather lower, near the piſiform bone, it turns backwards with a ſudden ſerpentine turn, and enters into the ſide of the ulnar arch, ſo as to make a complete inoſculation.

This deep palmar arch gives out many arteries; but as it lies cloſe upon the bones, they are all of the ſmalleſt order of arteries, and go only to the bones, and to the joints of the carpus and metacarpus. Thoſe branches again which run upwards, give little arteries to the interoſſei muſcles, to the lumbricales, to the long tendons, and to the interſtice of each bone. Small twigs are ſent through to the back of the hand, which are named arteriæ perforantes, and which inoſculate with the dorſalis carpi, or artery of the back of the wriſt; they alſo inoſculate with the arteries of the fingers.

ARTERIA ULNARIS.

THE ULNAR ARTERY, both from its ſize and its direction, is to be conſidered as the continued trunk of the

the humeral artery. It dives downwards and backwards into the triangular hollow which has been deſcribed, till it touches the interoſſeous membrane: It firſt gives off a ſmall branch to the pronator teres and common origin of the flexor muſcles, before it paſſes through them: Sometimes it gives off here the recurrent, which ſhould come from the interoſſeous artery; in which caſe that branch, as it paſſes backwards through the interoſſeous membrane, is named interoſſea poſterior ſuprema. Next the ulnar gives off the proper interoſſeous artery, which is named INTEROSSEA COMMUNIS, becauſe both the anterior and poſterior arteries are branches of it. Then the ulnar artery, lodged deep under all the muſcles which go off from the inner condyle, as the palmaris, pronator teres, flexor ulnaris, &c. perforates one of them, viz. the flexor digitorum. But though it paſſes through betwixt the upper and lower flexor, it does not, like the radial, appear immediately as a ſuperficial artery; it ſhows itſelf only about three inches above the wriſt. The ulnar artery, running along by the tendon of the flexor carpi ulnaris, paſſes forward from the wriſt to the palm of the hand by the ſide of the piſiform bone; it then forms the ſuperficial arch of the palmar arteries, and ſupplies all the fingers, as the radial ſupplies the thumb.

The arteries which the ulnar gives out after it paſſes through the muſcles, and before it arrives at the wriſts, are merely muſcular branches, extremely variable in ſize and number. To enumerate theſe would be but to repeat the names of all the muſcles which lie upon the flat part of the fore-arm.

As the radial ſends a branch over the back of the hand, named dorſalis radialis, ſo does this ſend a branch round the back of the little finger named dorſalis ulnaris.

ARTERIA DORSALIS ULNARIS.

THE DORSALIS MANUS ULNARIS is a ſmall branch which goes off from the ulnar artery as it advances towards

towards the wriſt. The ulnar artery goes forwards towards the piſiform bone, while this little artery turns off about two inches below, paſſes under the tendon of the flexor ulnaris, and round the head of the ulna, to the back of the hand; it then goes upwards along the back of the little finger, where it ends. It gives branches as it paſſes along to the pronator quadratus, to the extenſor ulnaris, to the joints about the lower part of the wriſt, and eſpecially to the joining of the radius with the ulna; and it finiſhes on the back of the hand by arteries given to the tendons and capſule, by inoſculations with the rete which is formed upon the back of the wriſt, by the radial artery, and by giving the dorſal artery of the little finger.

Next the ulnar artery, before it begins its arch, gives ſmall branches to the flexor tendons and fore-part of the wriſt; others to the piſiform bone, to the annular ligament, and to the palmaris cutaneus, and then branches to the flexor, abductor, and adductors of the little finger; or, in other words, to all that maſs of muſcular fleſh which ſurrounds the root of the little finger; and ſtill, before it begins to bend into an arch, and juſt beyond the piſiform bone, it gives off that branch which may be called ARTERIA PALMARIS PROFUNDA.

ARTERIA PALMARIS PROFUNDA.

THE deſcription of this artery is ſhortly this: It is but a ſmall artery; it comes off a little lower than the piſiform bone; it often gives the laſt lateral artery of the little finger; it then turns downwards and backwards with a large circle, paſſes through betwixt the two heads of the flexor digiti minimi; by this it gets into the deepeſt part of the palm, and there joins itſelf with that palmar branch of the radial artery which comes off at the root of the thumb; and by this inoſculation the deep palmar arch is completed.

The ulnar artery having now arrived at the root of the metacarpal bones, but above the tendons of the fingers, forms a great arterial arch acroſs the palm of the hand, which

which is named the SUPERFICIAL PALMAR ARCH; and this arch gives out the arteries for the fingers after the following order: It does not give off two arteries to each finger, one for each ſide, becauſe it does not lie at the root of the fingers: but inſtead of this it ſends out three ſingle arteries; each of theſe goes to the cleft betwixt two of the fingers; and when arrived at the roots of the fingers, theſe branches divide uniformly and regularly into two branches; of which one goes up along the ſide of one finger, while the other goes up the oppoſite ſide of the next finger; and thus all the fingers are ſupplied each with two arteries, one running along either edge of each finger. To number them according to the fingers one, two, three, were mere drudgery and waſte of time; and to name and deſcribe them were an abſolute abuſe, ſince they are ſo uniform in all points: It is ſufficient to obſerve, that a long and ſlender artery runs along each edge of each finger; that generally at each joint or diviſion of the finger the two arteries make arches to meet each other acroſs the hollow where the tendons lie, ſupplying the tendons and ligaments at the ſame time; and that the fork of each digital artery receives a branch from the deeper arch of the palm. That the arteries are each accompanied with correſponding nerves, one for each ſide of each finger; for the ulnar nerve accompanies the ulnar artery down the fore-arm, and branches along with it in the palm into the form of an arch, with three branches; which three branches are afterwards divided like the arteries, each into two twigs at the roots of the fingers.

The ſuperficial palmar arch finiſhes with a ſmall branch, which makes another inoſculation at the root of the thumb with that ſuperficial palmar branch which comes off from the artery of the thumb, near the place where the artery of the fore-finger alſo comes off.

ARTERIA INTEROSSEA.

THE INTEROSSEOUS ARTERY is, after the radial and ulnar, the laſt of the arteries of the fore-arm. It is but a branch of the ulnar; it ariſes from the ulnar juſt where

where it lies in the very deepeſt part of the arm, touches the interoſſeous ligament. This artery is named INTEROSSEA COMMUNIS, becauſe of two leſſer interoſſeous arteries into which it divides. Firſt the interoſſea communis divides about an inch below the elbow into the interoſſea anterior and interoſſea poſterior; next the interoſſea poſterior gives off the poſterior or interoſſeous recurrent. That artery is already deſcribed; and I proceed to deſcribe now the courſe of the two interoſſeous arteries.

Firſt, The anterior interoſſeous artery is the continued trunk, for it goes ſtraight forwards, and is larger; while the poſterior interoſſeous is ſmaller, turns out of the ſtraight courſe to perforate the membrane, and is exhauſted before it reaches the wriſt.

The anterior interoſſeous artery lies flat upon the fore-part of the interoſſeous membrane; is larger than a crow-quill, or about half the diameter of the radial artery. As it goes down the fore-arm, it gives branches to all the muſcles; it gives the nutritious arteries of the radius and ulna; it goes forwards, and, ending in ſmall branches under the annular ligament of the wriſt, it makes beautiful net-works and anaſtomoſis over the capſular joints of the carpus.

Secondly, The poſterior interoſſeous artery turns through the interoſſeous ligament about two inches below the elbow-joint. It inſtantly gives off the interoſſeous recurrent; which being very large, the artery ſeems to be divided into two equal branches, of which one is the recurrent, turning upwards towards the elbow-joint; the other is the poſterior interoſſeous itſelf, running downwards, and diſtributing its branches among all the great bellies of the extenſor muſcles which lie on the outſide of the fore-arm.

Thirdly, There is ſomething like a ſecond interoſſea poſterior; for the anterior interoſſeous artery ſends off, about four inches above the wriſt, another artery, but much ſmaller, which perforates the interoſſeous membrane; might be called a ſecond poſterior interoſſeous; though it is rather to be reckoned among thoſe ſmaller

twigs

twigs which, coming off from the anterior interoſſeous, and perforating the ligament, go through it to the extenſor muſcles, and are named PERFORATING ARTERIES, being from about four to ſeven in number.

CHAP. III.

OF THE ARTERIES OF THE THORAX, ABDOMEN, AND PELVIS.

§ I. ARTERIES OF THE THORAX.

AORTA THORACICA.

THE aorta from the arch (where the ſubclavians and carotids go off) bends downwards and backwards, and touches the left ſide of the ſpine. The two membranes called pleura of the right and left ſide meet in the middle to form the mediaſtinum; but as they do not meet immediately, they leave a triangular ſpace, the baſis of which triangle is the ſpine; the ſides are the two membranes of the pleura, inclining towards each other; and there, in the interſtice betwixt them, the aorta is lodged, and along with it lies the œſophagus, which runs downwards towards the ſtomach. The thoracic duct, which is paſſing upwards to the ſubclavian vein, and the vena azygos, which returns the blood of the thorax, and brings it into the deſcending cava; theſe parts are all involved in cellular ſubſtance, and incloſed in this triangular ſpace betwixt the two membranes.

The aorta, as it goes thus downwards beſides the ſpine, gives the following branches: Firſt, As it lies immediately

ately behind the root of the lungs, it gives ſmall arteries which nouriſh the proper ſubſtance of the lungs, the bronchial arteries: Secondly, As it lies by the ſide of the œſophagus, it ſupplies it with ſmall twigs, the œſophageal arteries: Thirdly, The aorta, as it moves downwards through the thorax, gives off a ſmall and regular artery to the interſtice of each rib as it paſſes it; and theſe are the INTERCOSTAL ARTERIES.

The BRONCHIAL arteries are always three, and ſometimes four, in number. Their office is not to contribute to the oxydation of the blood; that office belongs peculiarly to the pulmonic artery, while the ſmall bronchial arteries are for nouriſhing the proper ſubſtance of the lungs; for which end they attach themſelves immediately to the trachea, and follow its branches, twiſting round them through all the ſubſtance of the lungs.

1. ARTERIA BRONCHIALIS COMMUNIS.

THE COMMON BRONCHIAL ARTERY, ſo named becauſe it gives branches to both ſides of the lungs, ariſes higheſt from the fore-part of the aorta; it gives two branches, one to the right ſide of the lungs, and one to the left; the right branch gives an artery to the œſophagus, and ſometimes the whole of the right branch goes to that part.

2. ARTERIA BRONCHIALIS DEXTRA.

THE RIGHT BRONCHIAL ARTERY ſometimes, like the common bronchial, comes off from the aorta; but very often it comes off from the upper intercoſtal artery. It goes round the right branch of the trachea, and belongs to that ſide of the lungs alone: but it gives, notwithſtanding, ſome branches to other parts, eſpecially to the œſophagus, to the back of the pericardium, and to the poſterior mediaſtinum, or membrane which ſtrides acroſs the aorta.

3. ARTERIA

3. ARTERIA BRONCHIALIS SINISTRA.

THE LEFT BRONCHIAL ARTERY comes off along with the bronchialis communis from the fore-part of the aorta; it goes to the left ſide of the lungs, and alſo affords ſmall branches to the œſophagus and neighbouring parts.

4. ARTERIA BRONCHIALIS INFERIOR.

OFTEN there is a fourth bronchial artery, which we would call BRONCHIALIS INFERIOR, or the LOWER BRONCHIAL ARTERY, becauſe it comes off lower than theſe, commonly about the place of the fifth rib. It goes to the back of the heart, where the pulmonic vein of the left ſide expands into the auricle, and taking the pulmonic vein as a conductor, creeps backwards along it into the ſubſtance of the lungs.

Theſe bronchial arteries are the leaſt regular in all the body, coming off uſually from the aorta, but ſometimes from the mammary, and often from the upper intercoſtal artery; ſometimes alſo they ariſe from the intercoſtals of the aorta. But from one or other of theſe ſources we uſually have three or four bronchial arteries, which are ſo named from their belonging to the branches of the trachea or bronchiæ.

Ruyſch, who firſt diſcovered this artery, and Sylvius de la Boe and others who followed Ruyſch, and uſed his words in deſcribing the artery, explained its office truly: they ſaid it was for nouriſhing the ſubſtance of the lungs. But this ſenſible opinion was diſputed by many phyſicians of very great reputation; who maintained that it was quite diſproportioned to the ſize of the lungs, and that it nouriſhed the trachea only; and they gave a moſt whimſical reaſon for believing all this. The lungs they conſider as made of very coarſe ſtuff, which the half elaborated blood of the right ventricle and pulmonic artery might ſerve; while the harder and more perfect ſubſtance of the trachea required a more perfect and finer blood.

5. ARTERIÆ ŒSOPHAGEÆ.

THE ŒSOPHAGEAL ARTERIES are generally five or ſix in number. They are ſmall twigs which come off from the aorta below the bronchial arteries; they encircle the œſophagus, and make anaſtomoſes with each other; and very generally they paſs off from the œſophagus to the poſterior mediaſtinum, or that double membrane under the interſtice of which the aorta lies. Theſe ſecondary arteries, along with very ſmall twigs which come off from the aorta itſelf, ſome anatomiſts chooſe to deſcribe apart under the title of poſterior mediaſtinal arteries.

6. INTERCOSTALES INFERIORES.

THE LOWER INTERCOSTAL ARTERIES are nine or ten in number, according to the number of ribs which are not ſupplied by the upper intercoſtal artery (for the upper intercoſtal, which comes downwards from the ſubclavian artery, ſupplies uſually the intercoſtal ſpaces of the two firſt ribs), but ſometimes of three, and ſometimes of one only. The aorta, in its courſe down the back, gives out, as it paſſes each vertebra, one artery for each rib; as it goes down along the loins it ſtill gives off an artery at the interval of each vertebra; in the thorax they are named INTERCOSTAL, and in the loins the LUMBAR arteries.

The right intercoſtals are longer, becauſe they have to mount over the ridge of the vertebræ; the left ones are ſhorter, becauſe the aorta lies on that ſide of the ſpine: the intercoſtals often give ſmall twigs to the œſophagus and mediaſtinum; but beſides theſe, each intercoſtal artery gives three principal branches.

1. By the head of each rib it gives a ſmall artery, which belongs entirely to the ſpine, and this artery ſends one twig to the ſubſtance of each vertebra; another twig goes to the ſheath or dura mater of the ſpinal marrow; the third following each intercoſtal nerve back-

 wards;

wards, enters into the ſubſtance of the ſpinal marrow itſelf.

2. Each intercoſtal gives next a larger artery, which perforates near the head of each rib, and paſſes through to the back, and ſupplies the longiſſimus dorſi, latiſſimus dorſi, ſacro-lumbalis, and all the great muſcles of the back, which have indeed no other ſource whence they can derive arteries; and though theſe are apparently ſmall for ſo great a maſs of muſcular fleſh, the ſmallneſs of the branches is compenſated for by their frequency.

3. The intercoſtal artery proceeds, after giving theſe branches, along its proper intercoſtal ſpace, where it gives an immenſe number of ſmall arteries to the intercoſtal muſcles; and as each artery paſſes round the thorax along the ribs, it ſplits into two branches; one attaches itſelf to the lower edge of the rib above it, where there is a ſort of groove to receive it, that is, the larger artery, and the artery which is to be feared in wounds or operations; the other attaches itſelf to the upper ſharp edge of the lower rib, where there is no groove; this of courſe is the ſmaller branch, much leſs important in all reſpects. Theſe two accompanying each rib, run round the circle of the thorax to its fore-part, and inoſculate with the mammary and epigaſtric arteries.

§ 2. ARTERIES OF THE ABDOMEN.

AORTA ABDOMINALIS.

THE aorta deſcends into the belly under that arch which is formed by the legs of the diaphragm. It paſſes along the left ſide of the ſpine; but now upon emerging into the abdomen, it inclines nearer to the middle of that ridge which is formed by the vertebræ. The flat and tendinous legs of the diaphragm not only ſtride

ſtride over the aorta, ſo as to form an arch apparently for its protection; but the uppermoſt part of the crura turns flat under it, ſo as to embrace it. No vein goes along with the aorta; for the cava, which returns all its blood, leaves it a little above the pelvis, and inclines towards the right ſide, that it may enter into the right ſide of the heart, which it does by paſſing under the liver.

But the aorta has other very important connections; for as one of its firſt arteries is the great artery of the inteſtines, of courſe the root of the meſentery (the membrane which conducts the arteries of the inteſtines) lies over the aorta; and as the meſentery conducts the lacteals from the inteſtines, of courſe the meeting of the lacteals and of the lymphatics, or, in other words, the beginning of the thoracic duct, is at the ſide of the aorta. Again, as the great nerves which come down from the breaſt into the abdomen are deſtined chiefly for the viſcera, they have no other way of reaching the viſcera than by taking the direction of the ſeveral branches which the abdominal aorta gives out. There are three great branches; the cœliac, the ſuperior meſenteric, and the inferior meſenteric arteries. Of courſe there are three great plexus of nerves; the cœliac plexus, the ſuperior meſenteric plexus, and the inferior meſenteric plexus. As theſe net-works all come from the greater net-work which covers the aorta itſelf, that plexus is named, from its great ſize and from its many radiated nerves, the ſolar plexus; and the ſemilunar form of the two great nerves which ſupply the whole gives them the name of ſemilunar ganglions.

Theſe connections of the aorta, deduced in this general way, will be eaſily underſtood; will ſhew the importance of ſtudying this point, where there are ſo many intricate parts; and will explain alſo the neceſſity of mentioning this group of difficult parts at once.

The aorta then paſſes from the thorax into the abdomen, through betwixt the legs of the diaphragm; the beginning of the thoracic duct lies a little below this point, and the duct itſelf runs up by the ſide of the aorta.

The Aorta, having come out into the abdomen, the firſt branch which it gives off is a ſmall one to the diaphragm as it paſſes under it. The next branch which it gives off is the moſt important of all, viz. the cœliac artery; and it ſupplies the ſtomach, the liver, and the ſpleen, becauſe they lie in the upper part of the abdomen. Next it gives a great artery to the inteſtines, which is named the ſuperior meſenteric artery; for it goes to the inteſtines which lie within the abdomen. Then it gives the arteries to the kidnies and the ſpermatic veſſels. And, laſtly, it gives off a great artery, which is named lower meſenteric; becauſe it ſupplies chiefly the lower part of the great inteſtines, and moſt eſpecially the rectum, where it goes down into the pelvis.

Then the aorta divides into the two iliac arteries, and of courſe has no longer the name of abdominal aorta.

ARTERIÆ PHRENICÆ.

The diaphragm has in nine of ten bodies two arteries named the PHRENIC ARTERIES; one going to the right ſide, the other to the left. The varieties of this artery are too great almoſt to be mentioned; but, however, theſe are the chief: Generally the phrenic arteries are two ſmall arteries ariſing from the aorta, one going to the right ſide, another to the left; often there is one artery going off from the fore-part of the aorta, and dividing immediately into two arteries, right and left; ſometimes one ariſes from the aorta itſelf, another from the cœliac artery; ſometimes the cœliac artery, which has properly but three branches, has a fourth added, which is the phrenic artery; ſometimes there are three phrenic arteries; ſometimes even four; and the diaphragm, it is always to be remembered, receives often ſmaller branches from the intercoſtal and lumbar arteries, or from the capſular arteries, beſides thoſe which it gets from the thorax accompanying its nerves and coming along the pericardium.

Theſe varieties being mentioned, the hiſtory of the regular

regular phrenic arteries may be very ſhort. One goes round the right ſide of the diaphragm, and the other round the left, with very little variety. Firſt, the phrenic artery croſſes what is called the fleſhy part of the crus diaphragmatis of its own ſide, and goes bending along to what is called the ala or wing of the diaphragm, and gives a great many arteries in all directions into theſe fleſhy ſides of the diaphragm; the artery then turns round, and encircles the great central tendon, where the two phrenic arteries begin to turn round: they give one branch particularly large to the fleſhy ſides of the diaphragm, which ariſe from the ribs; then bending round the central tendon, they ſpread all their remaining branches forwards upon the central tendon, and upon that part of the muſcle which ariſes from the ſternum, and meet in large inoſculations with each other. One branch often pierces the diaphragm, goes into the pericardium where it is attached to the diaphragm, and unites with that artery which comes down along with the phrenic nerve, the comes nervi phrenici.

But ſtill it is to be remembered, that the phrenic arteries, before they enter into the diaphragm, give ſmall arteries to the capſulæ renales, and to the œſophagus and neighbouring parts; the œſophagean branch running upwards into the thorax, to inoſculate with the upper arteries of the œſophagus.

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§ 3. OF THE ARTERIES OF THE STOMACH, LIVER, AND SPLEEN.

THE upper part of the abdomen is occupied entirely by the ſtomach, liver, and ſpleen; the ſtomach in the middle, the liver on the right hand, and the ſpleen on the left. The cœliac artery ſupplies all theſe parts; it

 riſes

rifes up from the fore-part of the aorta a fhort thick artery encircled by the leffer arch of the ftomach; and immediately fplits into three branches, of which the middle branch goes to the ftomach, the left goes to the fpleen, the right goes to the liver; and thus we have all the branches of the cœliac artery neatly and fimply arranged.

ARTERIA CŒLIACA.

THE CŒLIAC ARTERY is fo important, that its place and connections muft be more minutely defcribed. It arifes from the fore-part of the aorta, juft at that place where the aorta is clofely embraced by the crura diaphragmatis, and over the eleventh vertebra of the back; it juts directly forwards, almoft at right angles from the aorta, and is encircled by the leffer arch of the ftomach; the artery ftanding up betwixt it and the diaphragm. The cœliac trunk, then, is fo placed as to be furrounded by thefe parts; it has the œfophagus on the left hand; the lobulus fpigelii, or lobulus papillaris of the liver, on the right hand; it has the leffer arch of the ftomach making its turn under it; and it has the diaphragm above, and the pancreas running acrofs below; it is covered by the delicate web of the omentum, named omentum minus, which goes from the leffer arch of the ftomach to the liver and to the fpine.

Now this fhort jutting out or ftump we call the trunk of the cœliac artery; or we call it axis arteriæ cœliacæ, for there is no other artery of the body that divides like it: the ftump, which is lefs than half an inch in length, ferving as an axis, from which the three great branches, viz. to the ftomach, liver, and fpleen, go off all at once, in a tripod-like form; one upwards, one to the right, and one to the left. The hepatic, which goes to the right, is largeft in the child, becaufe of the great bulk of its liver; the fplenic, which goes to the left, is larger in the adult; the gaftric is almoft always the fmalleft of the three.

I. ARTERIA

I. ARTERIA CORONARIA VENTRICULI.

THE CORONARY ARTERY of the STOMACH is the central artery of the tripod. When it belongs entirely to the ſtomach, it is ſmaller than the ſplenic or hepatic arteries: but when it gives (as often it does) a branch to the liver, it is the largeſt of the three. This gaſtric artery, or coronary artery of the ſtomach, is generally the ſmalleſt, not very much larger than a crow-quill; it riſes upwards, and turns a little towards the left ſide, becauſe the pyloric orifice of the ſtomach is there.

Before it reaches the pyloric orifice of the ſtomach, it divides itſelf into two great branches; one going round the cardiac orifice of the ſtomach, and the other returning along the leſſer arch.

CORONARIA SUPERIOR VENTRICULI.

THE branch which belongs to the cardiac orifice of the ſtomach attaches itſelf to the œſophagus, juſt where it emerges from the diaphragm, and is joined to the ſtomach: the artery turns round the œſophagus, paſſes firſt under and behind it, and then turns round and appears on the fore-part, or rather on the left ſide, of the ſtomach to ſpread over it. In the middle of this turn it gives off an artery which runs backwards along the œſophagus, takes directly the line of the œſophagus, runs up with it into the thorax a conſiderable way, inoſculates with the upper œſophagean arteries, and though a ſmall branch, it is long, and ſeldom wanting. The ſecond branch is a continuation of the ſame artery encircling the cardiac orifice, ſending its arteries down over the large and bulging part of the ſtomach, ſomewhat in the form of a crown. As the ſpleen is attached to this end of the ſtomach, this artery inoſculates with what are called the vaſa brevia, or ſhort veſſels coming from the artery of the ſpleen; and ſo it ends, having the name of CORONARIA SUPERIOR VENTRICULI.

The second branch of the coronary returns along the lesser arch of the stomach; it is so connected with the last that it may be called ramus coronariæ dexter, though properly it is not a branch, but the continued trunk of the gastric artery. As the first branch turns round behind the œsophagus, this stops and turns to the lesser arch of the stomach, touches it just at the cardiac orifice, *i. e.* at the root of the œsophagus; turns with a gentle turn round the lesser arch of the stomach, bending as the arch bends, giving its branches down both forwards and backwards over each side of the stomach. As it runs along the stomach it is sensibly exhausted by these arteries, so that it arrives very small at the lower or pyloric orifice of the stomach; there it turns over from the stomach upon the small gut in such a way as to belong to the pylorus or union of the gut with the stomach; and though small and trivial, it has an appropriated name, ARTERIA PYLORICA SUPERIOR, and thus the gastric artery ends.

But sometimes, as has been mentioned in the general description, the gastric artery sends a branch to the liver; yet, in that case, the order of these arteries already enumerated is in no degree disturbed; the artery running along the œsophagus, the artery running round the cardia and in form of a crown, the artery returning along the lesser arch, are still the same; only, after giving off this last artery, the trunk of the gastric goes off from the stomach, continues its course towards the liver, and passes into it.

2. ARTERIA HEPATICA.

THE HEPATIC ARTERY goes off from the cœliac axis, where it almost touches the point of the Spigelian lobe. The pancreas covers the root of the hepatic artery; it then turns a little forwards, and rising somewhat upwards at the same time, it passes under the pylorus, *i. e.* under the stomach and duodenum; it passes behind the omentum minus and biliary ducts; it arrives at the porta where the great vena portæ enters

the liver, and where the great biliary ducts come out; it passes betwixt the biliary ducts and the vein; and having a little before divided into two great branches, these now enter into the right and left lobes of the liver. In this place it is inclosed along with all the other vessels in that sheath of cellular substance which is called the capsule of Glisson.

Thus the artery finally terminates near the liver in two great branches, right and left; but before it does so, it gives, as it passes the stomach, duodenum, pancreas, very important branches to these parts. Before it gives these more important branches, it gives small twigs to the vena portæ and to the head of the pancreas; then it gives off the great artery which is the source of these lesser arteries (to the pylorus, pancreas, and duodenum), viz. the ARTERIA DUODENO-GASTRICA, which, soon after it goes off from the hepatic artery, divides into two chief branches. One turns backwards along the duodenum to the stomach, and from supplying the stomach and epiploon, is named GASTRO-EPIPLOIC ARTERY. The other, turning downwards along the duodenum, gives at the same time arteries to the pancreas, and so is named ARTERIA PANCREATICO-DUODENALIS.* The trunk which divides into these two arteries may be described thus: The duodenum begins from the pylorus; the pancreas pours its liquor into the duodenum; and therefore the head of the pancreas is attached to the duodenum: this marks the point at which the trunk of the ARTERIA DUODENO-GASTRICA goes off; for it rises at right angles from the hepatic; it lies behind the lower end of the stomach just between the pylorus and pancreas; there it splits into its two great branches, viz. to the duodenum and to the stomach. But besides these two great branches there are subordinate arteries, which must be enumerated together with them.

One artery goes off to the upper and back part of the duodenum over the biliary ducts; next go off small arteries to the duodenum of still less importance, and nameless; and at the same place small twigs are often given to the pancreas.

The

The firſt which is diſtinguiſhed or regular, or has a name, is the PYLORICA INFERIOR, the lower pyloric artery. It goes off from the PANCREATICO-DUODENALIS almoſt as ſoon as it touches the duodenum; there are ſometimes two or more pyloric arteries going off at this point; they encircle the pylorus with delicate branches; and at the ſame time turn obliquely upwards, to receive inoſculations from the upper pyloric, which comes from the artery of the ſtomach.

The next artery to be diſtinguiſhed by a peculiar name is one which goes off directly oppoſite to this, belongs to the pancreas, and is named, from its running tranſverſely acroſs the pancreas, the TRANSVERSE PANCREATIC ARTERY. It is a neat ſmall branch, which paſſes under the pancreas, runs along its back part, gives its arteries into the ſubſtance of the pancreas from ſide to ſide; and yet is not exhauſted till it has run along more than two-thirds of the length of this long gland.

The next branch is that from which the whole artery has its name: for the artery having given off the lower pyloric artery, and the tranſverſe artery of the duodenum, turns downwards, bending according to the circle which the duodenum makes, lying in the hollow ſide of that circle juſt as other meſenteric arteries lie along their proper inteſtines. In all this circle it gives continual arteries outwards to the duodenum; it gives alſo frequent arteries inwards to the pancreas. From theſe two connections this branch is peculiarly named ARTERIA PANCREATICO DUODENALIS. It ends in inoſculation with the meſenteric artery.

At the place where this pancreatico-duodenalis turns downwards, the other great branch turns backwards and upwards to reach the ſtomach. It is ſo great that it muſt be conſidered as the continuation and ultimate part of the artery. It goes to the ſtomach and epiploon, and thence is named gaſtro-epiploic artery.

The courſe of the gaſtro-epiploic artery is along the lower part of the ſtomach, and is moſt beautiful; it makes a broad ſweep round all the greater arch of the ſtomach;

ſtomach; it lies in that line where the great omentum comes off from the ſtomach; it ſends many and large branches upwards upon the ſtomach, both on its fore and on its back ſurfaces; it ſends oppoſite branches, very frequent and conſiderable, down into the web of the omentum or epiploon; it runs along the ſtomach till it meets with a ſimilar branch from the ſplenic artery; and the inoſculation between them is ſo large and perfect, that we cannot tell where the one artery ends or the other begins. This branch from the hepatic artery is named the right artery of the ſtomach, or the right GASTRO-EPIPLOIC ARTERY, while that from the ſplenic artery is the left.

Beſides this great artery to the duodenum and ſtomach, the hepatic artery, before it plunges into the liver, gives another branch, but ſmall; it is named pylorica ſuperior hepatica.

PYLORICA SUPERIOR HEPATICA.

THE PYLORICA SUPERIOR HEPATICA is ſo named to diſtinguiſh it from that upper pyloric artery which comes down from the ſtomach, and ſometimes it is called GASTRICA vel CORONARIA MINOR. It comes off from the hepatic artery juſt before it divides, or immediately after from the left hepatic. It turns backwards at an acute angle to the leſſer arch of the ſtomach, and having given ſmall twigs to the omentum minus, it goes directly to the pylorus, inoſculating with its upper and lower arteries.

HEPATICA SINISTRA.

THE hepatic artery, now advanced to within about two inches of the liver, divides into its two great arteries. Both go to the porta of the liver; but the one belongs to the right lobe, the other belongs to the left. The artery which belongs to the left lobe of the liver is ſmaller, and when there is an hepatic artery from the ſtomach it is very ſmall; it mounts over the vena

portæ,

portæ, and enters into the liver at the foſſa umbilicalis; its branches within the liver go chiefly to the left lobe, lobulus Spigelii, and anonymous lobe.

HEPATICA DEXTRA.

THE right branch of the hepatic artery paſſes under the biliary ducts, enters along with them into the right lobe of the liver, and before it does ſo it gives off the arteria cyſtica, or artery of the gall-bladder, one of the moſt beautiful little arteries in the body. The cyſtic artery branches over the gall-bladder betwixt its coats, in the form of a coronary artery, and having made a beautiful tree of branches over the gall-bladder, it paſſes off from it, and goes to the ſubſtance of the liver.

ARTERIA SPLENICA.

THE SPLENIC ARTERY is one of the moſt remarkable in the human body. The ſpleen is tied down to the left ſide of the diaphragm by a proper ligament; it is alſo connected with the greater or bulging end of the ſtomach by proceſſes of the omentum and by veſſels. The ſplenic artery, the largeſt branch of the cœliac, as large as a gooſe-quill, turns off from the cœliac trunk almoſt at right angles, and runs acroſs the abdomen to get to the ſpleen. It is in all this courſe exceedingly tortuous; it runs along the upper edge of the pancreas (which alſo lies acroſs the abdomen), and gives arteries to it; when it approaches the ſpleen, it gives off that great artery which returns along the lower border of the ſtomach, and when it actually arrives at the ſpleen, it divides into a great many branches, which enter by the concave ſurface of the ſpleen, and plunge into its ſubſtance.

The branches then, of the ſplenic artery, are theſe: 1. It gives a great artery to the pancreas named PANCREATICA MAGNA, which paſſes to the right under the pancreas, and belongs chiefly to the head of the pancreas, or that rounded end which is next to the duodenum,

denum. Though named magna, it is a variable artery, and of little importance. 2. All along, as the ſplenic artery is paſſing to the left by the border of the pancreas, it ſends ſhort branches into it. They are named PANCREATICÆ PARVÆ, or ſmall PANCREATIC ARTERIES. 3. It often ſends ſmall arteries upwards to the back part of the ſtomach, named POSTERIOR GASTRIC ARTERIES. 4. The GASTRO-EPIPLOICA SINISTRA, or the left gaſtro-epiploic artery, is a very large and principal branch of the ſplenic artery. It ariſes under the ſtomach a little beyond the left or larger head of the pancreas; it makes a large arch, and then turns with a ſerpentine turn towards the ſtomach, returns along the lower border of the ſtomach within the doubling of the omentum, and gives its arteries upwards to the ſtomach and downwards upon the omentum, ſo much like thoſe of the right gaſtro-epiploic artery, that when they meet in the middle of the great arch of the ſtomach, and inoſculate, we cannot diſtinguiſh where either of them ends; the chief difference is, that ſome of the epiploic branches of this artery are particularly large. 5. The VASA BREVIA are a ſet of three or four arteries which the ſplenic gives off juſt before it enters into the ſpleen; and as the artery lies cloſe to the ſtomach, theſe arteries which go to the great bulging of the ſtomach are exceedingly ſhort, and are thence named vaſa brevia. The artery ends by eight or ten branches, which plunge into the ſpleen. Sometimes we ſee the artery paſs, almoſt undivided, or divided into one or two branches only, into the boſom or ſinus of the ſpleen.

Theſe are all the arteries of the ſtomach, liver, and ſpleen, the viſcera which fill the upper region of the abdomen.

OF

OF THE ARTERIES OF THE INTESTINES.

OF THE UPPER AND LOWER MESENTERIC ARTERIES.

The bowels are ſo diſpoſed within the abdomen, that the largeſt of them, viz. the colon, the great inteſtine, encircles all the others. It begins on the right ſide in a blind ſac called the caput coli, or head of the colon: it goes upwards, and croſſes the belly, ſo as to ſupport the ſtomach, and ſeparate the ſtomach, liver, and ſpleen, from the ſmall inteſtines: it deſcends again into the pelvis at the left ſide, forming the rectum; and all the ſmall inteſtines hang by their meſentery in the central part of the abdomen, ſurrounded by this great inteſtine; and the arteries lie within the two lamellæ of the meſentery or ſupporting membrane of the inteſtines, ſo that they are called meſenteric arteries; and they follow the inteſtines in the order in which I have named them.

The GREAT OR SUPERIOR MESENTERIC ARTERY gives its firſt branches to the caput coli; its next branch to the middle of the colon under the ſtomach; the thouſand turns of the ſmall inteſtines next abſorb all its other branches. The LOWER MESENTERIC ARTERY, which gives no branches to the ſmall inteſtines, attaches itſelf to the left ſide, and eſpecially to the loweſt part of the colon, and goes down with the rectum into the pelvis, and ends there. This, then, may ſerve as a general plan or arrangement for the inteſtines and for the two meſenteric arteries.

1. MESENTERICA SUPERIOR.

It is not ſurpriſing that the UPPER MESENTERIC is the largeſt of all the abdominal arteries. It ariſes from the aorta, where it is ſtill betwixt the legs of the diaphragm,

2 and

and not more than half an inch below the cœliac artery. The cœliac and mefenteric arteries lie clofe upon each other; only we are lefs fenfible of their nearnefs by the axis cœliacæ jutting perpendicularly forwards, and by the trunk of the mefenteric running very obliquely downwards, and by the head of the pancreas lying immedi-[illegible]ly over the mefenteric and hiding its root. The trunk [illegible]nteric artery paffes under the pancreas, then through the mefocolon or mefentery of the colon, then into the proper mefentery of the fmall inteftines. It turns firft to the left; and then, by a fecond gentle bending, it turns again towards the right fide of the abdomen. It runs very low into the abdomen before it gives out any branches; and then it gives them off in the following order.

From the right fide it gives branches to the great inteftines, of which there are three chief arteries; but from the left fide, where it gives arteries to the fmall inteftines, it gives innumerable branches, very large, and fo inofculated with each other, that they form a fort of mefh or immenfe plexus in the mefentery before they go onwards to the guts. The undivided trunk of the artery is very large and long; the gentle curvature of it from left to right gives it the form of an Italic *ſ*; the prodigious fize of that mefh or plexus of veffels which goes to the great inteftines is fuch as to carry the artery down to the left ilium or flank, where the caput coli or conjunction of the ilium with the colon lies.

It is from the convex of this gently bending arch, and from the right or outer fide of the artery, that the following arteries to the great inteftines go off*. The COLICA MEDIA to the middle of the great inteftine, the COLICA DEXTRA to the right fide of the great inteftine, the ILEO-COLICA to the joining of the ilium with the caput coli or beginning of the great inteftine.

* Often before giving off its greater arteries, the mefenteric gives to the pancreas feveral fmall arteries; and to the duodenum two or three, which are fometimes named under the title of duodenales inferiores.

COLICA

COLICA MEDIA.

1. THE MIDDLE COLIC ARTERY paſſes along in the doubling, *i. e.* betwixt the two lamellæ of the meſocolon. It goes with a circular ſweep upwards towards that part or corner (as we may call it) of the colon which lurks under the liver; but before it touches [illegible] and generally at the diſtance of about three or four inches from it, this artery divides into two great branches; one turning backwards, along the right ſide of the colon, inoſculates with the colic arteries; the other, more like the continued trunk, turns upwards, bending according to the curvature of the arch of the colon, which ſupports the ſtomach; and having rounded the concave of this arch, and arrived at the left ſide, it there makes a great inoſculation with the left colic artery, which is a chief branch of the lower meſenteric; and ſo completes the great meſenteric arch, one of the moſt celebrated inoſculations in the whole body, that of the circle of Willis hardly excepted.

COLICA DEXTRA.

2. THE RIGHT COLIC ARTERY is enumerated as a diſtinct artery, chiefly for the ſake of plainneſs; for though ſometimes it ariſes apart from the general meſenteric trunk, yet in ninety-nine of one hundred bodies it proceeds from the upper or middle colic artery. It is a very large branch; it is ſet off from the colica media at a very acute angle; it moves along the right ſide of the colon, inclining alſo a little upwards towards the liver; it alſo ſplits when it approaches the gut into two branches; one turning towards the upper ſide to inoſculate with the middle colic artery, the other turning downwards towards the ilium or flank to inoſculate with the ileo-colic artery.

ARTERIA ILEO-COLICA.

3. THE ILEO-COLIC ARTERY arifes about an inch lower than the laft. It is a long, fmall, and flender artery compared with the two laft; which are fhort, ftumpy, and with contorted angles. This artery goes to the place where the fmall inteftines end, and the great ones begin; of courfe the membrane which holds the inteftines at this corner (I mean in the right haunch) changes its name from MEZZO-COLON (in the middle of the colon) to mefentery, or MEZZO-ENTERON (in the middle of the inteftines); and of courfe the ileo-colic artery runs down, not along the mefocolon, but along the mefentery. It goes directly down towards the joining of the ilium with the colon; it ends in three regular branches; one paffes ftraight onwards to the junction of the ilium and colon, fplits into two branches, one going over the fore and the other over the back part of the caput coli, and having a very curious correfpondence with the valve within, fo that it might be called ARTERIA VALVULÆ COLI. While this branch goes ftraight forwards over both fides of the caput coli, another branch runs backwards along the colon, and inofculates with the right colic artery; and another runs downwards along the ilium, and inofculates with the common branches of the mefenteric artery. It is from thefe two branches, which diverge like the reft of the colic arteries, that this is called ILEO-COLICA. Even the appendix vermiformis has its little mefentery tying it down to the caput coli, and from the back of the caput coli a little artery runs down upon that mefentery to the appendix, paffing along the whole length of that procefs.

From this point all the remaining arteries of the mefenterica fuperior go to the fmall inteftines; and they are fo undiftinguifhed, and fo prodigioufly numerous, that no branches can be defcribed or named; there is nothing but a great net-work of arteries to defcribe. The firft or radical branches which go to the fmall inteftines, are thick, large, fhort, and vary from twelve to fifteen

or twenty in number. But it is not theſe that make this vaſt appearance of a net-work; theſe twelve branches are firſt joined to each other, as it were mouth to mouth, forming one great confluence of arterial arches: from theſe, ſecondary branches ariſe, and they unite again in like manner, and make a ſecond row of arches; from the union of theſe ſtill other arteries ariſe, and make a third, or fourth, and even a fifth, row of arches, before any arteries go to the inteſtines; till at laſt the proper arteries of the inteſtines go out in ſtraight lines from the laſt arch, and ſpread upon the coats of the inteſtine. In ſhort, the meſentery has a very intricated and matted appearance; from the redoubling of theſe arches, which are more and more numerous as the artery proceeds lower, till the laſt of the twelve radical branches makes an arch, which ſerves the ileon or loweſt of the ſmall inteſtines, and inoſculates with the ILEO-COLIC ARTERY.

2. MESENTERICA INFERIOR.

THE LOWER MESENTERIC ARTERY is that which is named by Haller the left colic artery, becauſe it goes only to the left ſide of the colon. It ariſes from the fore-part of the aorta, below the two emulgent arteries, *i. e.* pretty low down. It goes off rather from the left ſide of the aorta; it goes off very obliquely, and keeps cloſe to the left ſide of the aorta for a great way; and when it has deſcended as low as the bifurcation of the aorta, it gives off its great branch to the left ſide of the colon, viz. the LEFT COLIC ARTERY; and then turning down over the iliac artery of the left ſide, it deſcends into the pelvis, along with the rectum, and ends there.

1. Its firſt branch is the ARTERIA COLICA SINISTRA. The lower meſenteric has run a conſiderable length, has paſſed as low as the bifurcation of the aorta, before this branch is given off. This artery ſoon divides into three large branches; the trunk itſelf is ſhort and ſtumpy, the branches go off like thoſe of the other ſide, at very acute angles: First, One branch aſcends towards the angle of the colon, under which the ſpleen lies, and there

there divides itſelf into two branches; one keeping cloſer to the inteſtine, nouriſhes it; the other keeping more to the middle of the meſocolon, or broad membrane of the colon, meets the branch of the upper meſenteric, and completes with it the meſenteric arch, being indeed the larger and more important artery of the two. Secondly, Another branch goes directly acroſs to the right ſide of the colon, and when it approaches the gut ſplits (as uſual with the colic arteries) into two leſſer branches, one turning upwards and the other downwards. Thirdly, The third branch of this left colic artery goes obliquely downwards to that part of the gut which lies in the hollow of the left haunch-bone, and which forms the turn named ſigmoid flexure of the colon; and the membrane of the colon is here ſo faſt braced down to the loins that this artery gives twigs to the loins inoſculating with the lumbar arteries.

2. ARTERIÆ HÆMORRHOIDALES.

THE INTERNAL HÆMORRHOIDAL ARTERY is one of conſiderable ſize; it is juſt the trunk of the lower meſenteric artery, deſcending into the pelvis; it is often as large as a writing quill; it applies itſelf cloſely to the back part of the rectum; it arrives at it by turning obliquely over the pelvis, and under the rectum, and paſſes down its whole length quite to the anus. It encircles the rectum completely on each ſide with its large branches, which meet again upon the fore-part of the gut, and its branches lower down in the pelvis inoſculate with the middle hemorrhoidal artery, and ſometimes with thoſe of the bladder and womb. This is the artery which prevents us from operating when a fiſtula in ano has gone deep by the back of the rectum; and which has given occaſion to the eſtabliſhing of ſomething like a general rule in ſurgery, that one ſhould not operate when the fiſtula is more than two or three inches deep. It is the laſt of the arteries belonging to the looſe and floating viſcera.

OF THE REMAINING ARTERIES OF THE ABDOMEN, VIZ. TO THE KIDNIES, TESTICLES, &c.

ARTERIÆ CAPSULARES.

THE capſulæ atrabiliariæ are two ſmall bodies of a triangular form, of thick walls and ſmall cavities, filled in general with a black and bilious-looking liquor. The ancients thought this the atrabilis, and named them the capſulæ atrabiliariæ: the moderns, from ſeeing them placed immediately above the kidney, and obſerving no apparent connection but with that gland, have named them capſulæ renales. They lie then above the kidney, are like the kidney ſurrounded with fat, have ſtraggling arteries from various ſources, but none regular nor important.

Firſt, They have very generally ſome ſmall branches from the phrenic arteries. Theſe are the higheſt of the capſular arteries; they touch the uppermoſt point of this glandular body. They are named the upper CAPSULAR ARTERIES. Secondly, They often have ſmall arteries from the aorta peculiar to themſelves, which come off about the root of the upper meſenteric artery, go to the fat and glands, and play over the vena cava (at leaſt thoſe of the right ſide do), and go to the middle parts of the gland, whence they are named CAPSULARES MEDIÆ. Thirdly, they have their laſt arteries ſent upwards to them from the emulgent artery, or artery of the kidney. They are named the lower CAPSULAR ARTERIES.

ARTERIÆ RENALES.

THE two RENAL or EMULGENT ARTERIES, the two arteries of the kidneys, go off from the ſides of the aorta, midway betwixt the upper and lower meſenteric arteries. Each goes to its kidney almoſt at a right angle, arching

arching a little over the bulging belly of the pſoas muſcle. The aorta is ſtill a little inclined to the left ſide, and ſo the left emulgent is ſhorter, and mounts over its accompanying vein; while the right kidney, being further off from the aorta, and ſomewhat lower, on account of the liver being on that ſide, the right artery is longer, and is covered by its emulgent vein. When the emulgent artery, which is ſhort and very thick, arrives at the concave edge of the kidney, it is divided into three or four large branches, which ſurround the pelvis, or beginning of the ureter, plunge into the ſubſtance of the kidney, and inoſculate and make arches with each other. Then they, in ſupplying the kidney within its ſubſtance, form circles and arches over the roots of the papillæ uriniferæ.

Before the emulgent arteries enter into the ſubſtance of the kidney they uſually give off ſmall arteries, as has been already mentioned, to the lower part of the capſulæ renales, to the upper part of the ureters, and to the fat ſurrounding the kidnies.

ARTERIA SPERMATICA.

THE SPERMATIC ARTERY, or artery of the teſticle, is one of the moſt ſingular, both for its extreme ſmallneſs and great length, and for its important office. It ariſes on each ſide from the lateral parts of the aorta, a little above the lower meſenteric artery. The left ſpermatic artery riſes ſomewhat higher, and often comes from the emulgent artery; it deſcends from the aorta almoſt in the ſame line with itſelf; it croſſes the vena cava, and meets its accompanying vein upon the ſurface of the pſoas muſcle; it then forms the ſpermatic cord, and paſſes obliquely through the ſpermatic paſſage and abdominal ring; before it goes down into the teſticle, it gives out many very ſmall twigs. Firſt, It gives ſmall twigs to the fat of the kidnies; ſecondly, It gives ſmall branches to the ureters; thirdly, Small twigs to the peritoneum; and laſtly, Small twigs to

 nouriſh

nouriſh the ſpermatic cord itſelf. When it has paſſed through the ring, it ſoon after divides into many ſmall arteries for the ſeveral parts of the teſticle, four or five in number; two of which go to the epidydimis, and two others, particularly large, go to the teſticle; the largeſt of theſe branches turns round the teſticle in a beautiful and ſerpentine form, waving along the upper part of the teſticle, viz. juſt under the epidydimis, and ſending beautiful coronary branches downwards all over the ſemicircle or convex ſurface of the teſtis.

Theſe are the chief arteries, viz. thoſe of the kidney and teſticle. Thoſe of the renal capſule I hold to be ſo irregular, that they hardly deſerve the ſhort deſcription which I have given of them. The following claſſes of ſmall and irregular arteries are equally inſignificant; for few authors have been at the pains to enumerate the arteries going to the fat of the kidney; and none (except Murray) have been at the pains to gather together into one claſs or deſcription the trifling arteries of the ureter.

ARTERIÆ ADIPOSÆ.

THE ARTERIES of the FAT of the kidney are extremely ſmall but numerous. The upper arteries come from the capſular and diaphragmatic arteries which are above the kidney; the middle arteries of the fat come from the renal artery itſelf, from the ſpermatic, or even from the aorta; the lower arteries come from the colic arteries, and one from the ſpermatic, which comes off below the kidney, and turns up towards its lower end.

ARTERIÆ URETERICÆ.

As the ureter is a long canal, its arteries come off from various parts which it paſſes. Its upper arte-

ries

ries are from the renal artery itſelf, before it enters the kidney; and alſo from the capſulars and ſpermatics. The middle arteries of the ureter are more particular and more important: they ariſe either from the aorta itſelf, or from the iliac artery, where the ureter croſſes it; and they run far, both upwards and downwards, along the canal. The loweſt arteries of the ureter ariſe from thoſe of the bladder itſelf.

ARTERIÆ LUMBARES.

THE LUMBER ARTERIES are thoſe which ſucceed to the intercoſtal arteries, and which run parallel with them; performing the ſame office in the loins which the intercoſtals do in the thorax, viz. nouriſhing the ſpine and the muſcles.

The lumbar arteries ariſe from the ſides of the abdominal aorta. The firſt arteries go off at right angles; the lower ones are a little inclined downwards. The right ones are longer, becauſe they have to riſe over the ſpine. The arteries of both ſides, as ſoon as they have left the ſpine, ſink under the pſoas muſcle, and go onwards behind it, round the ſide, till they terminate in the lateral muſcles of the abdomen. The uppermoſt lumbar artery is large; and as it runs along the loweſt rib but one, it of courſe gives arteries both to the tranſverſe or innermoſt muſcle of the belly, and alſo to the diaphragm, which indigitates with it in conſequence of their both taking their origin from the ſame ribs. The two lower lumbar arteries are ſmall, and begin to inoſculate with the leſſer arteries about the top of the pelvis.

Each lumbar artery gives out like each intercoſtal two chief arteries: 1. One which goes to the ſpine, and which, ſplitting into two, gives a larger twig to the vertebra itſelf; and a ſmaller one, which enters the ſheath, lies by the nerve, and paſſes into the ſpinal marrow. 2. A muſcular branch, which is alſo divided; for one branch of it ſupplies the pſoas muſcle, and then runs

runs round within the mufcles of the abdomen; while the other pierces the back, and fupplies the facro-lumbalis, longiffimus dorfi, and other mufcles of the loins.

ARTERIES OF THE PELVIS.

The aorta divides into two great arteries, named iliac arteries. The two iliac arteries move downwards to the brim of the pelvis, where they meet the veins of the lower extremity afcending to form the cava, and alfo a veft plexus of lymphatics from the legs and pelvis, which twift round the arteries and veins. The two iliac veins lie upon the inner fides of the two arteries; and fince thefe veins meet on the right fide of the aorta to form the cava, of courfe the right iliac artery croffes the trunk of the cava. This bifurcation of the aorta is much higher than the pelvis; it begins upon the fourth vertebra of the loins, fo that the abdominal aorta is in truth extremely fhort, and the iliac arteries go off at fuch an angle, that they diverge very gradually; fo that when they arrive at the top of the pelvis, they are juft over the joining of the haunch-bone with the facrum: and it is but a very little below this again that they divide into their two great branches; the one, named the external iliac, which paffes ftraight forwards into the thigh; the other, the internal iliac, which dives immediately down into the pelvis to fupply the internal parts.

ARTERIA SACRA MEDIA.

The bifurcation of the aorta gives off only one artery, which proceeds exactly from the fork; and being in the middle, it is a fingle or azygous artery, which has not a fellow. It is fmall, long, very regular, and paffes down

down ſo correctly in the middle of the bone, that it is named the MIDDLE SACRAL ARTERY. It is about the ſize of a crow-quill; paſſes directly over the middle of that projecting point which is named the promontory of the ſacrum; it deſcends expreſsly in the middle of the bone, quite to the point of the os coccygis. At the place of each vertebra (for the ſacrum conſiſts of vertebræ now united together), it gives off croſs branches, which go acroſs the body of the ſacrum to inoſculate with the lateral ſacral arteries. Beſides theſe, it gives arteries to the ſubſtance of the bone, and not unfrequently ſmall arteries to the rectum. This artery ends near the point of the os coccygis in a forked or double inoſculation with the lateral ſacral arteries of each ſide.

ILIACA INTERNA.

THE INTERNAL ILIAC ARTERY is of vaſt ſize; it not only ſupplies all the parts within the pelvis, but ſends out by the ſeveral openings of the pelvis thoſe great arteries which ſupply both the private parts, and the immenſe maſs of muſcle which ſurrounds the haunch. Thence the neceſſity and the uſefulneſs of arranging them under two claſſes: Firſt, Of the leſſer arteries which go to parts within the pelvis, as to the loins, to the ſacrum, to the bladder, and to the womb; and ſecondly, Thoſe larger arteries which go out through the ſeveral openings of the pelvis, the hips, the haunch, and the private parts.

This artery we cannot deſcribe in the adult, without attending to its condition and function in the child; for it is that indeed which gives it the peculiar form which we have to deſcribe; and which eſpecially gives it that arch downwards, from the convexity of which all the great branches go off. For in the child, the internal iliac or hypogaſtric artery is extremely large: Firſt it turns down into the pelvis with a large circle; then it goes cloſe to the ſide of the bladder very low into the pelvis; then it begins to riſe again by the ſide of the bladder, out of the pelvis, and going along by the ura-

chus

chus (which is a tube or ligament rather leading upwards from the bottom of the bladder), it goes out by the navel, forming the umbilical artery. Now this sudden turn by the side of the bladder makes the artery convex downwards, *i. e.* towards the parts which it has to supply. The artery keeps this same form in the adult; both in the child and in the adult all the great branches come off from the back of this arch.

ORDER FIRST.

The branches of the hypogastric or internal iliac artery, which remain within the pelvis.

I. ILEO-LUMBALIS.

This artery is so named, because it so resembles the lumbar arteries that it might be mistaken for the last of them; and because it belongs equally to the haunch-bone and to the loins. It goes off from the outer side of the iliac artery, about an inch below the bifurcation; it is about the size of the lumbar arteries, or a little larger; it turns in behind the iliac artery, and passes under the psoas muscle; its trunk is short, for it splits immediately into its iliac and lumbar branches. The lumbar branch goes off betwixt the last vertebra of the loins and the inner end of the ilium, and goes directly upwards; it gives its branches about the psoas muscle. The iliac branch setting off from the same point, runs straight outwards, lodges itself under the edge or crista ilii, and supplies the iliacus internus muscle by a superficial branch; and it nourishes the bone by a deeper branch, which lies close in the hollow of the haunch.

2. ARTERIÆ SACRÆ LATERALES.

The lateral arteries of the sacrum are very generally three or four in number. Sometimes we find one general artery coming off from the iliac, or from the

the ileo-lumbar artery, running down all the ſide of the ſacrum, and giving off the lateral ſacral arteries; but much more frequently we find three diſtinct arteries coming off from the ſides of the iliac artery, which run acroſs the ſacrum in the following manner, to inoſculate with the middle ſacral artery: Firſt, Each lateral ſacral artery has one large branch, which runs along the forepart of the ſacrum, runs along the naked bone, and inoſculates with the middle ſacral artery: Secondly, Another branch, ſtill larger, dives into each of the ſacral holes, which not only nouriſhes the nerves, and the ſheath of the cauda equina, and the bone itſelf by one branch, but penetrates by another branch through the poſterior ſacral hole, and ſupplies the perioſteum, the great ligaments which join the ilium to the ſacrum, and the root alſo of the ſacro-lumbalis, and glutæal muſcles. From theſe two branches (viz. to the ſpine and to the poſterior muſcles), and from the regularity of theſe five arteries (going from ſome artery or other into each ſacral hole), they reſemble the intercoſtal and lumbar arteries, to whoſe office and place they have ſucceeded.

ARTERIA HYPOGASTRICA.

THE HYPOGASTRIC ARTERY is the umbilical artery, of great ſize and importance in the child; and even in the adult it ſtill remains, in this ſenſe at leaſt, that though the forepart of it (where it turns up by the ſide of the bladder) is cloſed, even that part is ſtill known by a round ligamentous ſubſtance, into which it is converted, and which we eaſily trace up to the navel, where the artery meets its fellow of the other ſide.

This artery is even in the adult body pervious down to the ſide of the bladder, where in Man it gives one long and ſlender artery, ſometimes two, which go to the ſides of the bladder; and in Women, ſmall arteries to the womb, ſometimes to the rectum; but theſe branches are quite irregular in number and ſize.

ARTERIÆ VESICALES.

THE ARTERIES of the BLADDER are extremely irregular

gular both in number and ſize; for it is to be conſidered, that the bladder being a round body placed amidſt great arteries, and being itſelf membranous, and needing but few or but ſmall branches, it gets them from various ſources. Very generally the hypogaſtric, juſt before it cloſes into a ligament, ſends one or more ſmall arteries downwards and forwards to the neck of the bladder, at that part where the veſiculæ ſeminales lie; and of courſe the veſiculæ and the proſtate gland get ſmall twigs from this artery of the bladder; ſometimes alſo the bulb of the urethra has a ſmall artery from it.

ARTERIÆ HÆMORRHOIDALES.

The arteries of the rectum are all named hæmorrhoidal arteries. The upper hæmorrhoidal artery is the great branch of the lower meſenteric continued to the pelvis. The middle hæmorrhoidal artery is one which ſometimes comes from the hypogaſtric artery, but very often from the pudic artery, inſomuch as to be reckoned among its regular branches. The lower, or the external hæmorrhoidal artery, almoſt always is a branch of the pudic artery, or that artery which goes to the penis. Two great arteries, one going to the rectum and another to the womb, are the laſt which the hypogaſtric gives off before it degenerates into a ligament.

ARTERIA HÆMORRHOIDEA MEDIA.

The middle hæmorrhoidal artery is not a large branch. Often we do not find it, but other arteries ſupplying its place; ſometimes again it is ſo large as to give off both the uterine and the lateral ſacral arteries; but in general it is ſmall. It comes off from the hypogaſtric oppoſite to the glutæal artery (preſently to be deſcribed); it touches the rectum below its middle, and deſcends curling and winding chiefly along its forepart quite to the anus; and often it gives, as it runs betwixt the rectum and bladder, arteries to the bladder, proſtate gland, and veſiculæ ſeminales. It is this artery alſo which in women gives ſmall branches to the vagina.

ARTERIA UTERINA.

THE womb has four arteries, two from each ſide; the uppermoſt that which enters by the upper corners of the womb, comes from the aorta, correſponds with the ſpermatic in Man, runs along the broad ligament towards the ovaria. The lower artery of the womb, and the largeſt, comes from the hypogaſtric, enters the womb, where it is connected with the vagina, and runs upwards along the ſides of the womb to meet the ſpermatic; and it ſends alſo at the ſame time branches downwards into the vagina, and forwards upon the bladder, where it adheres to this part of the womb.

This uterine artery ariſes from the hypogaſtric near the origin of the hæmorrhoidal artery, and when it enters the womb it becomes very tortuous.

Theſe, then, are the chief arteries of the rectum, bladder, womb, veſiculæ ſeminales, and other parts within the pelvis.

ORDER SECOND.

OF THE ARTERIES WHICH GO OUT FROM THE PELVIS TO THE HAUNCHES, HIPS, AND PRIVATE PARTS.

IN this ſecond claſs or order there are juſt four great arteries; one which goes over the back of the haunch-bone to the glutæal muſcle, named Glutæal artery; one going downwards over the tuber iſchii to the hip, named the Iſchiadic artery; one which goes out of the pelvis, returns into it again, and paſſes out a ſecond time by the root of the penis, named the Pudic artery; and one which paſſes out through the thyroid hole into the deep muſcles at the top of the thigh, named Obturator artery. All theſe larger arteries go off from the convex of that arch which the hypogaſtric forms, and move backwards

wards and downwards, in order to eſcape from the pelvis.

Let it be remembered, that the iliac artery forks juſt at the meeting of the ilium and ſacrum; that the great ſacro-ſciatic notch is formed by this joining of the ilium and ſacrum, and is juſt under the junction of theſe two bones: that the glutæal artery paſſes out by this ſacro-ſciatic hole; and that of courſe it is the firſt, as well as the greateſt, of thoſe three arteries which turn backwards out of the pelvis.

ARTERIA GLUTÆA.

THE GLUTÆAL ARTERY goes off from the internal iliac immediately after the lateral ſacral arteries. It is exceedingly large, thick, and ſhort, within the pelvis, for it immediately turns over the bone; the turn which it makes over the naked bone is backwards and upwards; it inſtantly divides itſelf into a great laſh of veſſels, which ſpread in every direction, ſupply the two glutæal muſcles, and turn and ramify upon the back of the haunch-bone, juſt as the great ſcapular arteries play over the ſurface of the ſcapula.

The pyriform muſcle goes out from the pelvis at the ſame great opening with the glutæal artery, and the artery is further accompanied by the great ſciatic nerve; the artery and nerve paſs together over the pyriform muſcle, betwixt it and the bone; and when the glutæal artery is to give out its branches, it ſplits into two great branches at the edge of the glutæus medius muſcle. By this ſplitting the gluteal artery is arranged thus: Firſt, One great branch paſſes under the glutæus medius, of conſequence it is naked upon the back of the ilium; it ſends one large and beautiful artery, which courſes round the bone according to the line of the criſta ilii, which ſupplies all the upper half of the haunch-bone with its nutritious arteries, and ſupplies of courſe all the upper half of the great or outermoſt glutæal muſcle where it ariſes from the ſpine and dorſum of the ilium. Another large branch, ſtill belonging to this deeper artery, paſſes under

under the thickeſt part of the belly of the glutæus medius, lies upon the ſmall fan-like muſcle named glutæus minimus, and gives innumerable great branches to the middle and leſſer glutæi muſcles, and to the joint of the thigh-bone.

The other great branch of the glutæal artery ſlips in betwixt the glutæus major and the glutæus medius; and as it lies betwixt theſe two great muſcles, it gives a prodigious number of branches to each, but chiefly to the great glutæal muſcle.

ARTERIA ISCHIADICA.

THE SCIATIC ARTERY is ſo named, becauſe, inſtead of going upwards with this crooked turn towards the haunch, it goes obliquely downwards to the hip, in the direction of the main artery from which it comes. It comes off from the iliac about an inch lower than the glutæal, and is next to it in ſize, almoſt equal, when (as it often happens) the pudic artery is derived from it. The glutæal artery ſhould be contraſted with it thus: The glutæal goes out above the pyrifrom muſcle; the ſciatic goes out below it; the glutæal turns upwards over the haunch-bone, the ſciatic turns downwards along the hip; the glutæal ſpreads its arteries wide with ſudden and crooked angles; the ſciatic ſends its arteries downwards in a gentle waving form, or almoſt ſtraight; and ſo numerous as to be compared with a laſh of many thongs proceeding from one ſhaft.

Often the glutæal artery, before it paſſes out of the pelvis, gives ſmall twigs to the rectum, to the bone, and to the pyriform muſcle; and in like manner the iſchiadic, before it eſcapes from the pelvis, gives alſo trivial branches to the rectum, and to the pyramidal muſcle.

The branches of ſo great an artery, ramifying merely among muſcles, and among ſuch a vaſt variety of muſcles, can neither be named, nor are worth naming. All that is to be deſired is, to know the trunk, and the general direction in which its greater branches go. Among theſe branches there are few remarkable.

First,

First, The COCCYGEAL ARTERY turns quick backwards upon the sciatic ligaments, and lying under the glutæus magnus; and passing along by the direction of the ligament, it arises at that part of the sacrum whence the ligament takes its rise; and turning downwards upon the coccyx, and upwards upon the back of the sacrum it inosculates with the sacral arteries through the posterior holes.—Secondly, Another branch, more remarkable for its office than its size, runs downwards along the sciatic nerve, supplying its coats and substance.—But the great branch of this artery sends a confused lash of arteries downwards, which give arteries, first to the glutæal muscles and pyriformis, and then downwards to all those muscles of the back of the thigh which arise about the knob or tuber of the ischium. In short, all its chief branches are muscular; and the artery is remarkable for no other peculiarity than this, that its inosculations downwards with the reflected arteries of the thigh are so frequent, that these alone may save the limb in wounds of the femoral artery above its profunda, or that great branch which belongs to the thigh.

ARTERIA PUDICA COMMUNIS.

THE COMMON PUDIC ARTERY *, or the artery of the external parts of generation, is the third great artery which goes out from the pelvis backwards. And there is in the course of this artery a peculiarity which is never fully explained; and being unexplained, makes the succeeding description quite defective and lame: and it is this. The pudic artery (which is nearly of the size of a writing quill) usually comes off as a branch from the sciatic artery; it goes out from the pelvis along with the sciatic artery through the lower part of the sciatic notch, under the lower edge of the pyriform muscle, over the upper sacrosciatic ligament. But no sooner has it made its appearance along with the sciatic artery, and emerged from the pelvis, than it returns into the pelvis again; it

* It is named often the circumflex pudic artery, the internal pudic artery, the middle pudic artery, the great pudic artery.

does

does not go over the outſide of the tuber iſchii, and ſo down to the perinæum; but it juſt appears out of the pelvis, riſes over the upper ſacro-ſciatic ligament, gives out a few branches, turns in again under the lower ſacro-ſciatic ligament, or rather under the ſpine or ſharp point of the iſchium, whence that ligament ariſes: it is now within the pelvis again; it lies flat againſt the inner ſurface of the iſchium; it runs along by the direction of that bone till it approaches the ſymphyſis pubis, where the root of the penis is. It there dives into the root of the penis, having juſt before given off that branch which goes to the perinæum. It is this long artery, running naked and unprotected along the whole inner ſide of the iſchium, bending as the arch of the iſchium and pubis bends, that is cut by ignorant lithotomiſts, which a broad gorget is ſure to wound, and which can be ſafe only by our exchanging the gorget for the knife.

The branches of the pudic artery are chiefly theſe:—Firſt, Before it proceeds out of the pelvis, it uſually ſends branches inwards to the neck of the bladder, veſiculæ ſeminales, and proſtate gland:—Secondly, When it emerges from the pelvis, and while bending over the ſacro-ſciatic ligament, it gives, like the ſciatic artery, chiefly muſcular branches; it gives twigs to the ſacro-ſciatic ligament and pyriform muſcle; others go to the gemini muſcles, and turn over them to the great trochanter, and to the hip-joint, reaching as far as the acetabulum; others ſpread over the tuber iſchii, to which they give arteries, which go outwards along the three muſcles of the thigh which ariſe from this point; and it ſends inwards from this part an artery which encircles the verge of the anus, and belongs to the ſphincter and levator ani muſcles. This branch is named the LOWER OR EXTERNAL HÆMORRHOIDAL ARTERY: and other branches it ſends forwards into the perinæum; but theſe are ſmaller and leſs regular arteries; they are not what are diſtinguiſhed by the peculiar name of perinæal arteries. This artery, like the iſchiadic, ends every where in inoſculations with the reflected arteries of the thigh.

Thirdly, The artery returning again into the pelvis, and running along under the flat internal ſurface of the

 iſchium,

iſchium, gives off many ſmall branches to the bladder, proſtate gland, veſiculæ ſeminales, and rectum. But when it has reached the perinæum, and is about to emerge from the pelvis a ſecond time, and go into the root of the penis, it gives out three chief arteries; one to the perinæum, one to the body of the penis, one to the back of the penis thus:

When the artery has approached nearly to the muſculus tranſverſalis perinæi, it ſplits into two branches; one of which is the artery of the perinæum; the other is the proper artery of the penis.

ARTERIA PERINÆI.

The ARTERY of the PERINÆUM paſſes under the tranſverſalis perinæi and betwixt the accelerator and and erector penis; in ſhort, it comes out from that triangular cavity which we cut into in lithotomy; in which operation of courſe this branch cannot eſcape. The artery having eſcaped from this triangular cavity, runs forwards along the perinæum for two or three inches, according to the ſize of the ſubject, growing very ſenſibly ſmaller as it goes along. It is chiefly for ſupplying the ſkin and muſcles of the perinæum; and gives theſe branches: 1. When it has juſt come out from the triangular hollow, it gives off from its root one branch at right angles, which goes directly acroſs the perinæum; it keeps the courſe of the tranſverſe muſcle; it may be named ARTERIA TRANSVERSALIS PERINÆI, and ends about the ſphincter ani. 2. It gives branches to the accelerator and erector muſcles. 3. It gives branches to the ſcrotum; and being continued along the corpus cavernoſum of each ſide, it ends upon the tendinous ſheath, which binds the corpora cavernoſa. Thus ends the perinæal artery.

ARTERIA PENIS.

THE PROPER ARTERY of the PENIS is the continued trunk of the pudic artery. It is much larger than this perinæal branch; is as big as a crow-quill; it keeps ſtill cloſe to the bone, while the perinæal artery goes outwards; it at laſt touches the ſymphyſis pubis, and of courſe

courſe pierces the corpus cavernoſum, juſt where it takes its riſe from the leg of the pubis: and here it ſplits into two great branches; one to the corpus cavernoſum, and one to the back of the penis, or rather into three, ſince there is one alſo for the bulb of the urethra.

The bulb of the urethra is quite inſulated in the perinæum, while the corpora cavernoſa ariſe from the bone. Now, firſt, as the artery of the penis is paſſing by the ſide of the bulb, it gives off an artery to the bulb ſidewiſe, which in part plunges into the bulbous ſubſtance, and in part is ſcattered upon the accelerator, proſtate gland, &c.

Secondly, The artery having riſen to the place where the root of the corpus cavernoſum is, gives off that artery, which runs ſmall and delicate along all the back of the penis, till it ends at laſt in a branch which encircles the corona glandis. This is named the arteria dorſalis penis.

Thirdly, The artery now plunges deep into the proper ſubſtance of the penis; the artery of each ſide goes into each corpus cavernoſum at its root, and ſplits into two branches; theſe run chiefly along the ſeptum, or partition betwixt the corpora cavernoſa of each ſide. It is this artery which pours out blood ſo freely into the cells of the penis, and cauſes erection.

Theſe three, the glutæal, the ſciatic, and the pudic arteries, are the only ones which go out from the pelvis behind, and one only goes out by an opening on its forepart or rather its lower part, viz. the obturator artery.

ARTERIA OBTURATORIA.

THE OBTURATOR ARTERY is ſo named from its paſſing through the thyroid hole. No artery is leſs regular in its origin; ariſing ſometimes from the iliac, ſometimes from the hypogaſtric, and not unfrequently from the root of the epigaſtric artery: in which caſe it turns back again over the pubis, coming into the pelvis through the ring. But no artery is more regular in its deſtination; a conſiderable artery always paſſes through the thyroid hole, to ſupply the muſcles which take their origin from the membrane, and from the ramus of the os pubis.

The obturator artery, arising from the iliac or hypogastric, runs along by the upper edge of the pelvis, by the lower edge of the psoas muscle, accompanied with the obturator nerve, which is to go through the hole along with it. Having arrived at the forepart of the pelvis, it slips through the oval hole by a very small opening, which is in the upper part of the tendinous membrane, which closes that hole, and which is consequently at the upper edge of the obturator internus muscle. The artery, before it passes out of the pelvis, often gives branches of considerable size downwards to the neck of the bladder, prostate gland, and veficulæ; to the iliacus internus and psoas muscles, and to the lymphatic glands which lie upon them; and there is always a branch, which encircles the upper part of the foramen thyroideum, lies close upon the bone, and gives its twigs upwards into the muscles of the belly.

After the artery has passed along with its nerve through the thyroid hole, it comes into the very heart or central part of the thigh. Almost all its branches are muscular; none are worth distinguishing by name; it is only the general tendency of the artery that needs to be explained. It divides into two chief branches, taking opposite directions. The first is deeper; it turns downwards and outwards towards the hip-joint. It performs three services here; it gives first arteries to the periosteum, to the capsule, and to the gland within the acetabulum; it gives also large branches to the obturator, quadratus femoris, and all the great muscles which immediately surround the joint; it also forms very large and important anastomoses round the joint, with the sciatic and pudic arteries from the pelvis, and with the reflected arteries from the thigh.

The more superficial branch of the thyroid sends all its branches into the great muscles upon the inner side of the thigh coming from the pubis. Its chief branches are to the upper part of the triceps muscle; it sometimes gives branches even to the superficial muscles, as the gracilis and sartorius; always, at least, small twigs pass through these muscles to the skin of the thigh and to the scrotum.

ſcrotum. Of theſe two arteries, this ſuperficial one encircles the inner edge of the thyroid hole, or that which is next the pubis, with one of its branches; while the deeper artery encircles the outer edge, or that which is next to the hip-joint; ſo that they meet upon the bone inoſculating with each other.

CHAP. IV.

ARTERIES OF THE LOWER EXTREMITY.

ILIACA EXTERNA.

THE EXTERNAL ILIAC ARTERY is that branch of the common iliac which deſcends under Poupart's ligament into the thigh. The internal iliac or artery of the pelvis parts from this within the pelvis at the joining of the ilium and ſacrum. The external iliac paſſes down into the thigh, by bending along the upper edge or brim of the pelvis, directed by the lower edge of the pſoas muſcle, which alſo deſcends into the thigh. This great artery is accompanied by the anterior crural nerve; its correſponding vein lies by the ſide of it; the lymphatics of the thigh creep upwards along this artery into the pelvis; and when the artery deſcends into the thigh, it paſſes ſo over the bulging part of the acetabulum and head of the thigh-bone, that it is felt projecting there and beating with amazing force.

ARTERIA EPIGASTRICA.

THE EPIGASTRIC ARTERY, ſo named from its running up along the belly, goes off from the inner ſide of the

the external iliac artery about an inch before it paſſes out into the thigh.

The epigaſtric, when firſt given off, turns downwards with a full round turn till it touches Poupart's ligament. The peculiarity of its courſe here muſt be very carefully attended to. The femoral artery lies at the very outer margin * of the opening, called the crural arch. The Fallopian ligament forms the upper line of the crural arch. The epigaſtric artery moves inwards and downwards with the Fallopian ligament, running along its lower edge; then it croſſes the opening called the abdominal ring, behind the ring, and alſo behind the ſpermatic cord which paſſes through the ring; then it mounts by the border of the tranſverſe muſcle, and gets to the rectus muſcle of the belly; but it is pretty high before it touches the ſide of the rectus, and lying on the outſide of the peritoneum, and on the inner ſurface of the rectus muſcle, and keeping in the direct line of the rectus muſcle near its centre, or rather nearer the outer edge of the muſcle, and inclining inwards, it mounts from the groin to a little below the borders of the thorax, where it inoſculates very freely with the internal mammary artery. Theſe are the inoſculations which were mentioned in ſpeaking of the internal mammary artery. Through its whole courſe this artery is ſo large as to make its wounds important: we ſhould know where to ſtop it in wounds; we ſhould remember to avoid it in opening or extirpating tumours. I have ſeen ſome confuſion and much loſs of time during an operation from not attending to this. The main artery muſt be remembered; its branches are of little value. The only branches which it is at all neceſſary to mention are, firſt, one ſmall twig, which it ſends downwards along the ſpermatic cord; ſoon after entering under the abdominal muſcle, it gives off a large branch almoſt equal to the artery itſelf, which goes directly towards the navel, and ends there. This branch goes obliquely

* Viz. that end of the ſlit or arch which is neareſt to the haunch-bone.

liquely acrofs the mufcle, while the main artery follows the general line of the mufcle, and gives branches on every fide to the rectus, tranfverfalis, obliquus; in fhort to all the mufcles of the abdomen, and fpreads its laft branches very freely about the lower border of the cheft.

ARTERIA CIRCUMFLEXA ILEUM.

THE CIRCUMFLEX ARTERY of the HAUNCH is named CIRCUMFLEXA from its turning directly backwards, and ILEUM from its paffing along the hollow of the haunch-bone.

It is fmaller than a crow-quill; it goes off from the outfide of the external iliac artery oppofite to the epigaftic, or rather a little lower; exactly at that point where the outer end of the Fallopian ligament begins in the haunch-bone. It runs backwards in a curved line along the hollow of the haunch bone, curving along the crifta ilii, or ridge of the ilium, under which it lies. Its line is along the moft naked part of the bone, where the internal iliac mufcle begins on one hand, and the tranfverfe mufcle of the belly on the other: in fhort, it runs along all the upper edge of the internal iliac mufcle, quite round almoft to the lumbar fpine, where it joins the ileo-lumbar artery by fmall inofculations; for at this place the reflected iliac artery, which grows gradually and fenfibly fmaller, is almoft fpent. There are no remarkable branches which deferve to be defcribed or even to be named, unlefs it be one which goes off early, near the head of Poupart's ligament, and gives branches to the ligament, to the fartorius mufcle which arifes at the fame point of the haunch-bone, and to the edge of the iliac mufcle. And as it runs along betwixt the iliac mufcle on the one hand, and the tranfverfe of the belly on the other, it gives many branches downwards to the internal iliac and pfoas mufcles, and to the fubftance of the bone; and upwards it gives three or four branches into the abdominal mufcles, which go fo far

far along the belly as to inofculate with all its other arteries.

THE FEMORAL ARTERY.

The projection of that part of the great artery which we muft now call the femoral artery is occafioned not merely by the naked pelvis and the head of the femur; thefe parts are covered by the flefh and tendons of the pfoas magnus and iliacus internus, which alfo come out from the pelvis to the thigh. The artery lies cufhioned upon thefe mufcles; the mufcles dive very deep to get at the trochanter minor or inner trochanter of the thigh-bone. The artery follows them; and thus it is plunged as it were into a deep cavity, affumes a new pofition, and this conftitutes a fecond point of defcription.

The hollow in which the artery now lies may be compared with that of the bend of the arm. The artery now takes the name of femoral, lies deep in a hollow furrounded by much fat and many glands; the cavity is covered with a very ftrong fafcia, or tendinous fheath, which defcends from the mufcles of the belly over Poupart's ligament, and which is greatly ftrengthened at this point by the general fafcia of the thigh. Here the femoral artery, inftead of fending off lefs effectual branches from point to point as it moves downwards, and which could not have conveniently penetrated through all the thicknefs of the thigh, fends off one great branch, which furnifhes all the thigh without exception, whence it is named the mufcular artery of the thigh. This great artery goes off from the femoral juft like the ulnar from the artery at the bend of the arm, *i. e.* very deep among the mufcles, in the triangular cavity above defcribed. Thence it is oftener named profunda than mufcular artery.

The femoral artery having fent down this great branch, equal almoft to itfelf in fize, inclines outwards again, meets the inclined line of the fartorius, and follows its

oblique

oblique direction, aſſuming a new character; for now it becomes a ſecond time quite ſuperficial, is covered by nothing beſides the ſtrong faſcia of the thigh and by the ſkin. It is felt beating along the line of the ſartorius muſcle; and by that line we apply the cuſhion of our tourniquet. It retires from our feeling only about two hands breadth, or a little more, above the joint of the knee; at which place it perforates the triceps or great muſcle of the thigh, gets from the fore to the back part, or, in other words, forſakes the thigh to go down behind into the ham, where it exchanges its name for that of popliteal artery.

The popliteal artery, when it has got into the ham, meets with its correſponding nerve, which is of vaſt ſize; and the artery lies now flat upon the back part of the thigh-bone, paſſes down in a hollow formed betwixt its great condyles, lies flat upon all the back of the knee-joint, is encloſed by the two great hamſtring muſcles from above, and by the two great heads of the gaſtrocnemii muſcles below. But although we ſay it is protected, yet in truth it is not tightly bound down by a faſcia embracing it, but lies on the contrary ſo looſe and unſupported among the cellular ſubſtance, that we have the moſt certain evidence of its being often racked and ſtrained in ſudden or awkward motions of the joint.

From the ham the artery deſcends into the leg, under the heads of the gaſtrocnemii muſcles; and being lodged behind the great bulging, or head of the tibia, below the joint, it there divides into three great arteries. One paſſing down behind the tibia is named poſterior tibial artery; one perforating the interoſſeous membrane goes down along the forepart of the tibia, is named tibialis antica; the third artery, paſſing down behind the fibula, is named the fibular or peronæal artery. Theſe may be juſtly compared with the three arteries of the fore-arm; and as thoſe meet in arches upon the palm of the hand, theſe meet and form ſimilar arches on the ſole of the foot.

Even from this ſlight and general deſcription of this important artery, many concluſions may be deduced not indifferent

indifferent to the ſurgeon; for there are ſeveral points in the courſe of this artery very peculiarly marked.

Firſt, It is thrown ſo forwards by the bulging of the pubis, where it forms the ſocket for the thigh-bone, it beats ſo ſtrongly juſt under the rim of the belly, that we cannot, at leaſt till we try, doubt of its being eaſily compreſſed. I ſee, indeed, that Acrel, in very deſperate circumſtances, when his ligatures had given way even before his eyes, and the arteries burſt, and after the ſurgeons had been twice deluged with the blood of the femoral artery, thought that he had ſuppreſſed this artery, by reſting on it with his thumbs. But indeed the poor patient, under theſe horrible circumſtances, as Acrel juſtly calls them, muſt have fallen ſo faint and low, by a tedious alarming operation, and by the repeated bleedings, that any thing might have ſuppreſſed the pulſe in the femoral artery, when that of the heart itſelf was well nigh gone *. But this is one of the points in which it is the moſt neceſſary for every man to ſpeak from his own experience. I have tried it in the moſt favourable circumſtances in a ſlender young man; and when I thought myſelf ſure of the point, behold the blood guſhed out with a whizzing noiſe and prodigious force. I have ſeen others try it, and fail. It is perhaps not impoſſible to compreſs the femoral artery; but it is not an eaſy thing, and is an expedient never to be truſted where the life of a fellow-creature is immediately in danger.—Secondly, The ſtrong covering of the faſcia gives a peculiar form to the aneuriſm of the thigh; it keeps it flat, forces the blood to ſpread abroad into the ſurrounding parts; and this deep driving of the blood among the muſcles, together with the great ſize of the ſac, and the putrefaction of three or four pounds of blood, cauſes that gangrenous and ſloughing condition of the parts, by which we are ſo often foiled in our beſt concerted operations, and after the artery has

* "His in horrendis anguſtiis, cum nec nova ligatura, nec torcularis contractione hæmorrhagia ſiſti poſſet, in trunco ipſo, dùm ex inguine prolabitur, pollicibus firmiter admotis, compreſſionem inſtituere placuit, quo effluxus ſubſtitit."

been

been well and fairly tied.—Thirdly, It is very obvious that the profunda might with more propriety be named the femoral artery, ſince it is the proper artery of the thigh; and though Heiſter, and ſome of the beſt among the old ſurgeons, ſpoke of this diviſion as one which only ſometimes took place, we know that a leg could no more be without a profunda than without what we call the femoral artery; and we alſo perceive, notwithſtanding the doubts and fears of ſome modern ſurgeons, that when the femoral artery is wounded, it is after all only a wound of the artery of the leg.——Fourthly, The large branches which the profunda ſends upwards round the haunch, inoſculating with the ſciatic and pudic arteries, and the branches which it ſends downwards to the knee, inoſculating round that joint with the arteries of the leg, make this branch of peculiar importance to the ſurgeon; for when the artery is wounded in the groin, above the profunda, this branch ſaves the thigh, by its inoſculations round the haunch; and when the artery is wounded in the thigh, below the profunda, or in the ham, it ſaves the leg by its inoſculations round the knee; and when the whole line of the femoral artery has been obliterated, it has ſaved the whole extremity, as I have elſewhere proved, by receiving the blood from the arteries round the haunch, and conveying it down to the arteries below the knee, being thus an intermedium betwixt the internal iliac artery and the arteries of the leg, capable of forming a new line of circulation behind the thigh when that before is ſhut up. Nor ſhould it be forgotten, that the aneuriſm on the forepart of the thigh may be from the profunda; and then the femoral artery which lies before it may be cut acroſs by a raſh or ignorant ſurgeon.

Fifthly, The place of the femoral artery paſſing through the triceps muſcle is next to be obſerved, for theſe reaſons. At that point it lies cloſe upon the bone; and as this happens exactly at that diſtance above the knee at which we uſually amputate, we expect in ſuch amputations to find the great artery cloſe by the bone. As the artery is at this point tied down by the tendon of

the

the triceps, and is in fact paſſing through a tendinous ring, it ſometimes happens that when we have cut near this, but not upon it, the fleſh ſhrinks in ſuch a way that even this great artery, though it bleeds, is not eaſily found; but one ſtroke of the ſcalpel, running along the bone, cuts the tendon up, and expoſes the artery with open mouth.——This ſingle point makes all the difference betwixt an aneuriſm of the thigh and of the ham; it is peculiarly neceſſary to mark this, in order to aſcertain the extent of the diſeaſe before beginning an operation. Nothing can have a worſe appearance than that which has actually happened, viz. a ſurgeon beginning that operation in the ham, which he ſhould have attempted rather on the fore-part of the thigh; and being forced to change his ground, and to begin a ſecond operation on the fore-part of the thigh, or, what is worſe, to cut up the tendon, and follow the diſeaſed artery to the fore-part of the thigh, cutting, in ſhort, firſt longitudinally betwixt the hamſtrings, and, after an hour's working perhaps, cutting croſs-wiſe to reach the fore-part of the thigh.

6thly, Is it not a matter of very high importance to ſtudy the ham ſtill more carefully than the axilla, ſince the artery is ſo often hurt at this place by rude motions of the joint? For it is a narrow cavity; the artery lies cloſe upon the joint and bones; and when it is allowed to remain long in a diſeaſed ſtate, enlarging and dilating the ham, we perform in the end a hopeleſs operation; or, if we had hopes when we began our operation, they are all over before it is ended: for the parts are found to be diſeaſed, the bones carious, the joint ſpoiled; there is no hopes even of preſent ſafety, and of the ligature holding, and much leſs any expectation of a permanent cure. Often the greateſt ſurgeons have been contented to finiſh ſuch an operation by cutting off the limb!

7thly, When the artery has gone down beyond the ham, and ſeems lodged ſafely under the gaſtrocnemii muſcles, ſtill it is not ſafe; it is bended tenſe over the back of the joint; it is preſſed by the gaſtrocnemii ſtretching

ſtretching over it; and their violent action has often been ſuch, as to have torn the artery with a tumour ſo immediate, and with ſuch excruciating pain, that the ſurgeon has been conſtrained in a manner to cut off the limb even upon the ſpot.

8thly, Very often we are obliged to decide, whether a tumour of the thigh or a tumour of the ham can be cut away only by our knowledge of theſe arteries. How often the anterior arteries of the leg are cut by workmen, and how much they are expoſed to the ſtroke of the adze or axe, every practical ſurgeon muſt know: but the miſchances that open arteries are quite unthought of. I have known a man ſtanding careleſsly by his ſcythe, which was ſet upright, the blade along the ground, and the ſhaft reſting upon his arm, cut the artery behind the outer ankle ſo as to form (when the wound healed) a large, livid, and ſtrong beating aneuriſm, ready to burſt, and requiring immediate operation.

The epigaſtric artery is in danger in operations for hernia. The femoral artery is the ſubject of frequent operations; the popliteal aneuriſm is a diſeaſe of this artery in the ham; and even the ſimple operation of amputating either the limb, itſelf, or tumours in the thigh or ham, requires a perfect knowledge of all theſe arteries.

But although no formal operation affected theſe leſſer arteries, yet the main artery itſelf is ſo expoſed, and ſo ſuperficial where it runs down the thigh, that it is wounded in a hundred various ways. It is very ſingular how often it has been wounded by one particular accident, viz. the dropping of a pair of ſciſſars, and with a ſudden inſtinctive effort clapping the knees together to catch them. It has been wounded once or twice by a ſhoemaker clapping his knees thus together to catch his ſharp-pointed paring-knife. One of my pupils lay three months in London, uncertain whether his femoral artery was wounded; for he had in this way catched his penknife, the point of which had run into his thigh, and wounded ſome great artery. It has been cut acroſs by balls; it has been wounded even by a ſingle ſlug; it has been

been uncovered by wounds which yet did not touch its coats, and has in consequence dilated into an aneurism. I have known a boy stab another with a pen-knife in the thigh, and strike so critically as to open the artery with a wound like that of a lancet. My friend Mr. Harkness gave me the privilege of dissecting an aneurismal limb which he was obliged to cut off; and in which the artery was (if I may use such an expression) broken or torn across the upper end of the thigh-bone, which had been broken by a fall about three weeks before.

All these accidents must come upon the surgeon very suddenly; and if they come upon him unprepared, all is in a moment lost. I once saw a fine young fellow die from this alarm of the attendants and confusion of the surgeon. He was a tall, stout, young man, who was sitting at table with his companions eating bread and cheese, taking his glass, and telling his tale. He had in his hand a sharp-pointed table knife, which he happened to hold dagger-wise in his hand, and in the height of some assertion or oath he meant to strike the table, but the point missed, and slanted over the table; he had stabbed himself in the femoral artery, and with one gush of blood he fell to the ground. When I came, I found the young man stretched out upon the floor; he was just uttering his last groan; the floor was deluged, all slippery, and swimming with blood. The wound was covered with a confused bundle of clothes, which I instantly whirled off; and in that moment two gentlemen, who had been first called, and who had both run off for tourniquets (because tourniquets are used to stop bleedings), returned; and had the unhappiness to see that the hole was no bigger than what I could close, and had actually shut up with the point of my thumb; and which, had it been shut and put together with a good compress, would have healed in three days, forming a large beating aneurism within, allowing time for a deliberate operation.

In short, to enumerate the variety of accidents which may affect this artery would be impossible; but surely from the little that I dare venture to say in this place, it

muſt ſeem one of the largeſt, the moſt expoſed, and moſt dangerous, and by all this the moſt important, artery in the body; and from theſe previous hints and general deſcriptions, the value of the ſeveral branches which are now to be enumerated will be more eaſily felt and underſtood.

BRANCHES OF THE FEMORAL ARTERY.

THE femoral artery, until it gets down into the hollow which I have deſcribed, gives no branches, or none with which I would chooſe to confound the deſcription of the profunda or great artery of the thigh. The branches which the femoral gives off before that are only ſmall twigs to the fat, glands, ſkin, or private parts; but one or two of thoſe to the private parts are ſometimes large.—Firſt, Twigs go out along the femoral ligament, and terminate in the ſkin.—Secondly, Twigs go to the fat, and lymphatic glands of the groin.—Thirdly, There aſcends a ſmall branch, ſometimes towards the origin of the ſartorius, to the middle glutæal muſcles, and to the beginning of the faſcia lata.—Fourthly, Of thoſe branches which go acroſs the upper part of the thigh to the genitals, and which are named PUDICÆ EXTERNÆ to diſtinguiſh their branches from thoſe of the pudica communis, there are uſually three. The uppermoſt is ſcattered about the fat of the pubis. The middle one goes acroſs the heads of the triceps; it is longer and larger than the others; it goes to the ſide of the ſcrotum and penis in Men; in Women it is large, and runs into the labium pudendi. The lower one of the three goes to the lower parts of the ſcrotum, and to the ſkin of the thigh near it.

ARTERIA PROFUNDA FEMORIS.

THEN comes off the profunda femoris, the DEEP or MUSCULAR ARTERY of the THIGH. It ariſes from the femoral artery about four inches below the groin, more or leſs according to the ſize of the ſubject. It turns off

off from the femoral artery with a bulging, which looks backwards and towards the outſide of the thigh. It lies deep in the triangular cavity, upon the face of the iliacus internus and pectinalis muſcles. It preſently gives off two great arteries, which turn upwards along the joint; one round the outer ſide, the other round the inner ſide, of the joint. Then it paſſes downwards, turns in behind the femoral artery, ſinking deeper and deeper towards the back parts of the thigh. It paſſes down along the face of the triceps muſcle; and as it moves along its fore-part, it ſends through three or four great arteries to the back part, which are called the perforating arteries of the thigh. And, laſtly, the profunda itſelf, or its laſt branch, paſſes through the triceps; and this laſt branch is named perforans ultima vel deſcendens femoris.

ARTERIA CIRCUMFLEXA EXTERNA.

THE CIRCUMFLEX ATERY, which goes to the outſide of the hip-joint, proceeds from the very higheſt point of the profunda. It takes its courſe outwards, paſſing under the ſartorius, faſcialis, and head of the rectus: it runs over the tendinous head of the vaſtus internus, where that muſcle takes its riſe from the outer trochanter: it divides very early into the following branches.—Firſt, Branches go to the inner ſide, to the internal iliac muſcle, upon which this artery lies; and round it they bend over the leſſer trochanter, making inoſculations with the internal circumflex artery.—Secondly, An artery goes in the oppoſite direction, viz. outwards, to the iliac muſcle, the ſartorius, the head of the rectus, the faſcialis, and round to the glutæal muſcles.—Thirdly, It ſends many leſſer branches upwards and forwards into the heads of thoſe muſcles which I have juſt enumerated, and which lie immediately over the artery.—Fourthly, It ſends large branches round the root of the great trochanter, ſome of them going into the hollow above the trochanter; others keeping ſo low as the root of the trochanter, where the greater glutæus

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is inserted.—Fifthly, The most important of all its branches is a very long one, which it sends directly downwards under the rectus, or betwixt it and the vastus internus muscle. This artery is divided into two great branches, which run down the whole length of the thigh, somewhat resembling in their shape the PROFUNDA HUMERI: they are named the greater and lesser descending branches of the circumflex artery, and they inosculate in a most particular manner with a large anastomosing branch from the femoral artery. The larger branch of this artery emerges from betwixt the rectus and vastus externus, a little above the knee, to inosculate with one of the articular arteries of the knee. Its smallest branch inosculates with the anastomosing branch of the femoral artery. These two anastomoses seem to be the chief use of these two long arteries, though they do also send some branches to the muscles.

But to give a more simple notion of this circumflex artery, it should be described thus. It is divided into three chief branches: 1st, A descending branch, which goes down to the knee-joint; 2d, A transverse branch, which crosses the upper part of the thigh, and turns round the neck of the thigh-bone; 3dly, It sends a less important branch up upon the dorsum ilii.

ARTERIA CIRCUMFLEXA INTERNA.

THE INTERNAL CIRCUMFLEX ARTERY is a thick short artery, which goes off opposite to the ball of the thigh-bone; and as the external one goes round the great trochanter, this goes round the lesser trochanter. It is a smaller artery; it has not so many muscular branches; it keeps closer to the joint; it goes off from the inner side of the profunda, just opposite to the circumflexa externa, or a little lower, but never more than an inch lower; it passes over the insertion of the psoas muscle, and under the belly of the pectinalis; it attaches itself then to the lesser or inner trochanter, and goes round the neck of the thigh-bone round the joint, and

is expended on the mufcles at the back of the joint, as the quadratus femoris, gemini, &c.

The artery having turned towards the infide, the mufcles which lie there are the triceps gracilis, &c. The firft branches, therefore, which this artery gives off before it paffes under the pectinalis, are to the triceps and gracilis. After having paffed under the pectinalis, and while it is turning round the root of the leffer trochanter, it gives branches to the pectinalis and triceps; and efpecially it gives to the capfular ligament of the hip joint an artery which is named articularis acetabuli.

The artery now lying upon the pelvis, under the neck of the thigh-bone, divides itfelf into two chief arteries; one goes upwards and forwards along the triceps, till it ends at laft round the fymphyfis pubis. The chief mufcular twigs of this branch are given to the triceps, and to the obturator mufcles; it is this branch which inofculates fo freely with the branches of the obturator artery; it is a twig of this artery which enters into the cavity of the hip-joint, by that breach which is in the inner edge of the acetabulum; and this branch entering then by its proper hole, goes to the gland in the bottom of the focket, or chiefly to it. The other branch turns away in the oppofite direction, viz. backwards betwixt the little and the great trochanter, turning round the neck of the thigh-bone. It gives branches alfo to the triceps and obturator, inofculating with the obturator artery. But its chief branches are towards the other fide, as to the capfule of the hip-joint, to the neck of the thigh-bone, to the quadratus femoris. It is this artery which gives moft of thofe branches about the roots of the trochanters named trochanteric arteries; and it is from this artery that many branches go backwards along the tuber ifchii, to unite with thofe of the fciatic and pudic arteries.

OF

OF THE PERFORATING ARTERIES.

The two firſt perforating arteries are very large; the two next perforating arteries are ſmaller and leſs regular; the fifth perforating artery is juſt the termination of the profunda. But ſtill it muſt be underſtood, that theſe perforating arteries are extremely irregular in place, ſize, and number, as indeed all muſcular arteries muſt be; and that there are, beſides the greater perforating arteries, many like them in this part of the thigh, though not diſtinguiſhed by name.

ARTERIA PERFORANS PRIMA.

The first perforating artery is the largeſt branch of the profunda, bigger than both the articular arteries joined. It ariſes from the profunda, juſt under the leſſer trochanter, betwixt the pectinalis and triceps brevis; and perforates the triceps about an inch below the trochanter, and cloſe upon the thigh-bone. Here the artery lies under the lower edge of the glutæus, and cloſe by the origin of the biceps, ſemi-tendinoſus and ſemi-membranoſus muſcles, the three muſcles which form the hamſtrings; and the chief diviſion of the artery is into one great branch, going upwards along the glutæus, and another going downwards along the flexor muſcles. Firſt, The artery which goes upwards turns over the glutæus, ſpreads innumerable branches about the great trochanter; and meeting with the trochanteric branches of the arteriæ reflexæ, make a moſt beautiful inoſculation, or rather net-work of inoſculations, over the trochanter. Another tranſverſe branch of this upper artery turns quite round the lower part of the trochanter, and round the thigh, among the fleſh of the vaſtus internus; and a third branch of the ſame artery meets in inoſculation with the lower branches of the ſciatic artery.

The lower or deſcending branch of the perforans prima goes down along the three flexor muſcles of the leg, viz. the biceps, ſemi-tendinoſus, and ſemi-membranoſus;

branosus; nourishes their fleshy bellies, and plays over their surface in beautiful net-work.

ARTERIA PERFORANS SECUNDA MAGNA.

The second or great perforating artery is a much larger and more important branch of the profunda than this first, at least it is so when the other perforating branches are wanting, and when this, as often happens, represents the continued trunk of the artery: but I shall describe it as a second perforating artery, to be succeeded by others *. The second perforating artery comes off from the profunda, about two inches lower than the first; it passes through betwixt the first and second heads of the triceps, or through the flesh of the second; and turning obliquely downwards and backwards, close by the thigh-bone, it passes into the cellular interstice betwixt the flexor muscles of the opposite sides, *i. e.* betwixt the bellies of the hamstring muscles, and ends there.

Before it passes through the triceps, it gives branches to the triceps and vastus, and to the great trochanter, and to the thigh-bone. Its two chief branches, after it perforates the triceps, are, first, one great transverse branch, which goes directly across below the tendon of the glutæus, and gives one great branch up upon the glutæus, and another to the vastus externus, making inosculations with the reflected arteries of the joint. Secondly, Its descending branch goes down in the hollow betwixt the great hamstring muscles, and its branches go into both muscles, but chiefly into the biceps, and in these the artery is exhausted.

ARTERIA PERFORANS TERTIA.

The third perforating artery comes off about a finger's breadth lower than the former; it makes a

* My reason for saying this is, that sometimes there are but two perforating arteries, while there are often five which need to be described.

gentle waving turn inwards before it pierces the triceps; and after having perforated the triceps, it gives its branches to both the hamſtring muſcles, but chiefly to the ſemi-tendinoſus.

ARTERIA PERFORANS QUARTA.

THE FOURTH PERFORATING ARTERY may be regarded as the laſt, or as the termination of the profunda, though ſometimes there is a fifth. It perforates again ſtill lower, about a finger's breadth below the laſt, through the fleſh of the triceps magnus. Its firſt branch, while on the fore-part of the triceps, is the nutritia magna femoris, or proper nutritious artery of the thigh bone; and after it perforates the triceps, it gives its arteries to the two hamſtring muſcles, but more eſpecially to the biceps; and ſo this laſt branch of the profunda ends.

But this minute deſcription of any important ſet of arteries never preſents any clear idea to the reader's mind, nor any knowledge which he can eaſily retain, I expect rather to do ſo by one ſhort deſcription.

The title of PERFORATING ARTERIES is one which comprehends all the great muſcular branches of the profunda, except the two reflex arteries belonging to the joint. They vary in number, as all muſcular branches muſt do, and are proportioned in ſize and number to the bulk of the thigh. The profunda paſſes down along the fore-part of the triceps, while it is giving off theſe arteries; they muſt, of courſe, perforate the triceps before they can get to the back part of the thigh. When they do perforate, they come into a great muſcular interſtice or hollow, which is formed by the hamſtring muſcles of oppoſite ſides, by the biceps on one ſide, and by the ſemi-membranoſus and ſemi-tendinoſus on the other. It is to theſe two great muſcles of the back part of the thigh that the branches of all the perforating arteries are chiefly directed. Each perforating artery ſucceeds another at about the diſtance of an inch or more; each ſucceſſively coming out into this interſtice at

at a lower and lower point. Each artery gives branches to the triceps, &c. before it perforates, and to the hamstring mufcles, &c. after it has come into the hollow. The two firft perforating arteries are the only arteries which are large and abfolutely certain; the third is always very much fmaller; the fourth is generally the termination of this great artery; the fifth perforating artery is rare.

Such a general idea as this of their fize and value, and fituation in the very heart or deepeft part of the thigh (for the profunda turns backwards from the very firft, and all its branches keep the fame direction), is of more importance than a particular knowledge of every branch of each perforating artery; a thing really unattainable, fince they vary more in their ultimate branches than almoft any other arteries in the whole body; for they have more fpace, and a greater mafs of irregular mufcle to wander in, and produce varieties.

ARTERIA FEMORALIS.

Though the profunda is plainly the artery of the thigh, yet from the ignorance of anatomifts and furgeons (who never knew till about twenty years ago that there was more than one great artery) the fuperficial artery has been named the artery of the thigh.

The femoral artery makes a fpiral or ferpentine turn round the whole thigh. It appears firft on the forepart; it turns obliquely round to the inner fide, following the lower edge of the fartorius mufcle; it paffes through the triceps, after it has got about two-thirds down the thigh, by which it gets into the ham, and its fpiral turn is completed. It lies deep where it is giving off the profunda; it rifes then, and is fuperficial all along the middle of the thigh; and when it has advanced two-thirds down the thigh, it again gets too deep to be felt; but all along it is covered by the thick ftrong fafcia of the thigh. Through the whole of this courfe it gives no one branch out that is of any confiderable importance. They are all mufcular arteries,

ries, very ſmall, nearly of one ſize, nameleſs, and undiſtinguiſhed, going into the muſcles of the fore part of the thigh; or if any are diſtinguiſhed, it is only by their relation to other arteries, when the trunk gets low enough to make anaſtomoſes with the arteries of the joint.

The nameleſs muſcular branches of the Femoral artery go, in one word, to all the muſcles on the fore-part of the thigh; to the rectus, ſartorius, vaſti, gracilis, and triceps; to the glands, faſcia, fat, and ſkin; and it thus continues giving ſucceſſive branches to each of theſe long muſcles as it paſſes the ſeveral points of them.

There is no diſtinguiſhed branch till, having arrived within two hands' breadth of the knee-joint, it gives out (juſt where it is about to paſs through the tendon of the triceps) a larger branch named (like a ſimilar branch of the humeral artery) RAMUS ANASTOMOTICUS MAGNUS.

This branch goes out from the inner ſide of the femoral artery juſt where it is about to perforate the triceps; it paſſes into the fleſh of the vaſtus internus; it firſt ſends ſmaller branches to the vaſtus internus and ſartorius, and through the interſtice of theſe two muſcles to the ſkin of the knee. But having penetrated into the fleſhy belly of the vaſtus internus, this artery, which is itſelf very ſhort and thick, ſends out its ſlender inoſculating branches: one goes downwards along the tendon of the great triceps; and when the tendon of that muſcle ſtops above the inner condyle, this artery goes forwards over the condyle, makes a net-work upon it, joining in numberleſs inoſculations with the articular arteries from below, and gives twigs alſo into the joint. The other branches of this ramus anaſtomoticus tend all forwards and upwards to join the deſcending branches of the reflexa externa, which come down along the rectus muſcle.

There are two other arteries lying cloſe upon the joint, remarkable enough to deſerve a name, and they are called perforating arteries; not perforating like the branches of the profunda, to get deeper among the fleſh;

 but

but perforating ſo as to get out from the cavity of the ham upon the ſurface of the thigh again.

The UPPER PERFORATING ARTERY ariſes from the inner ſide of the popliteal artery, juſt after it has perforated the triceps; but it muſt not be accounted a popliteal branch, becauſe it immediately perforates the triceps muſcle again. It gives branches to the ſemi-tendinoſus, ſemi-membranoſus, and ſartorius; in ſhort, it turns its branches towards the muſcles on the inner ſide of the knee, and is a ſmaller artery.

The LOWER OR SECOND PERFORATING ARTERY goes off nearly oppoſite to this. It is a much larger artery. In order to eſcape from the ham, it perforates the ſhorter head of the biceps, or outer hamſtring muſcles. It firſt croſſes the ham at its very upper point, and within the ſubſtance of the triceps; it then perforates the ſhorter head of the biceps flexor-cruris; it then emerges upon the thigh by the belly of the vaſtus externus muſcle. Before it paſſes acroſs the ham, it gives a branch to the ſemi-membranoſus; while it is paſſing through the fleſh of the biceps, it gives a lower nutritious artery to the lower and back part of the thigh-bone; after it perforates the biceps all its branches are to the fleſh of the biceps and vaſtus externus, and its extreme branches are ſpent in inoſculations with the deſcending branch of the reflex or articular artery of the hip-joint.

But theſe branches, which are the laſt of the femoral artery, are extremely irregular. There is no artery from the profunda downwards worth naming, not even thoſe which I have juſt deſcribed *.

* "Confiteri tamen oportet, binos ultimos ramos in diſtribuendis ſuis ſurculis infinite ludere, ita ut deſcriptione ad quodcunque cadaver adaptata vix, ac ne vix quidem comprehendi poſſint. Ex repetitis tamen meis diſſectionibus id pro certe habeo, duos vel tres, quos perforantes appellare vellem, exoriri, hos trunculis ſuis ad externum latus præcipue conflecti cumque rete vaſculoſo genu jungi, nutritiant inferiorem ex iiſdem gigni, et ramos inſuper, nunc pauciores, nunc numeroſiores, communicantes ad flexores cum profunda clevari." *Arvidſon*, p. 36.

POPLI-

POPLITEAL ARTERY.

THE artery having paſſed through the ring or tendon of the triceps which is formed for it, or rather having paſſed betwixt the triceps and the bone, lies flat againſt the flat part of the thigh-bone as deep as poſſible in the cavity of the ham. There, as no muſcles are lodged, it can give no muſcular arteries of any importance; none but trivial ones to the hamſtrings or to the heads of the gaſtrocnemii. In its whole length from the place of its perforating the triceps tendon to its great diviſion, which is under the longer head of the ſolæus muſcle, it gives none but articular arteries, *i. e.* ſmall arteries to the knee-joint, which are no leſs than five in number, and encircle it in all directions.

Firſt, the popliteal artery ſends off from each ſide two muſcular branches, not deſerving a particular name nor deſcription; the one goes to the biceps or muſcle of the outer hamſtring, the other to the ſemi-tendinoſus and ſartorius, or inner hamſtring muſcles.

Then come off the arteries of the joint, which are thus arranged: 1. The upper arteries coming off above the joint are three in number; one turning round the inner ſide of the joint, and one round the outer ſide, and one in the middle; whence it is named azygous, as having no fellow. 2. The arteries below the joint are two only in number; one to the inner ſide, and one to the outer ſide, of the joint; and theſe directions of the arteries ſettle both the order of deſcription and alſo their names.

ARTERIA ARTICULARIS SUPERIOR EXTERNA.

THAT upper articular artery which comes off above the knee, and which turns round the outer ſide of the joint, ariſes from the popliteal artery above the outer condyle; its trunk is like all theſe arteries about the joints, ſhort and ſtumpy; but its branches long and ſlender. It paſſes under the fleſh of the biceps; it appears again at the edge of the vaſtus externus: one branch

branch plunges into the vaſtus externus, mounts upwards, and, beſides ſupplying the muſcle, inoſculates with the long deſcending branch of the reflexa externa; while another branch turns as directly downwards over the face of the outer condyle, and ſpreads beautifully over the ſide of the joint, inoſculating in many net-works with the correſponding artery from below.

ARTERIA ARTICULARIS SUPERIOR INTERNA.

THE UPPER ARTICULAR ARTERY of the INNER ſide goes off in like manner over the inner condyle, pierces the tendon of the triceps, where it is implanted into the condyle, and paſſing under the edge of the vaſtus internus, turns towards the fore-part of the knee, proceeds towards the patella, and covers chiefly the inner ſide of the joint with its net-work of inoſculations; its little twigs ſlip in under the great lateral ligament, and under the ſides of the patella to the cavity of the joint itſelf. It inoſculates like the outer artery with the lower arteries of its own ſide.

ARTERIA ARTICULARIS MEDIA.

THE MIDDLE or AZYGOUS ARTICULAR ARTERY uſually ariſes from the back part of the popliteal artery, but ſometimes from one or other of thoſe laſt deſcribed; but this branch, at all events, is ſeldom wanting. It runs down behind the main artery upon the back part of the joint, into the great hollow betwixt the condyles; and all its branches are expended upon the back of the capſule, the poſterior crucial ligament, the ſemilunar cartilages, and the fat about the back of the joint.

LOWER ARTICULAR ARTERIES.

THE lower articular arteries are more ſlender, longer, run downwards very low, and return upwards with a very ſudden angle.

ARTE-

ARTERIA ARTICULARIS INFERIOR EXTERNA.

The external ARTICULAR ARTERY below the KNEE goes off from the popliteal at the middle or centre of the joint, turns downwards along with the popliteal artery for a confiderable way; it paffes under the heads of the fmall plantar mufcle and the outer head of the gaftrocnemius, and having paffed through, encounters the head of the fibula, and paffes above it to the fide of the joint, fpreading its branches towards the patella.

In the ham this artery gives mufcular branches to the heads of the mufcles, as of the gaftrocnemius, folæus, plantaris, and the popliteal mufcle, that mufcle which lies obliquely acrofs the ham. When it reaches to the fide of the joint, it paffes under the external lateral ligament; and feveral of its branches, befides their external anaftomofes, go into the cavity of the joint, one of which within the joint is efpecially large.

ARTERIA ARTICULARIS INFERIOR INTERNA.

The INTERNAL ARTICULAR ARTERY below the knee is larger than the external one. Like it, it bends downwards, paffes under the inner head of the gaftrocnemius mufcle, croffes behind the head or rather neck of the tibia, on the inner fide of the knee. It firft gives arteries to the back of the joint; then it communicates downwards with a large recurrent artery from the tibialis antica; it inofculates upwards with the articularis fuperior interna; it contributes (as all the other articular arteries do) to the forming of that profufe network of arteries which is fpread over the whole of the capfule of the knee-joint. It fends alfo, like the others, certain twigs, which creep under the internal lateral ligament, and go into the cavity of the joint along the borders of the femi-lunar cartilages.

Thofe who write on aneurifms of the ham talk much of thefe arteries. They compare them with the recurrents of the arm; and think, when they fee five articu-

lar

lar arteries, that it is a ſure ſign that at ſuch a point all is ſafe; when theſe arteries are all deſtroyed by the long compreſſion of the popliteal aneuriſm, or are ingulphed in the bag of the aneuriſm. If they ever appear, it is not as inoſculating arteries, enſuring the ſafety of the limb; but as ſmall branches burſting into the ſac, embarraſſing the operator, and confounding every thing, ſometimes filling the ſac a-new with blood, after all was thought to be quite ſafe, and the patient laid in bed.

Before the popliteal artery paſſes under the head of the ſolæus, it gives two long arteries, which run down upon the two heads of the gaſtrocnemii muſcles. It often alſo ſends ſmall twigs to the head of the ſolæus, and to the popliteal and plantar muſcles.

OF THE THREE ARTERIES OF THE LEG AND FOOT.

The three arteries are, the tibialis antica, going on the fore-part of the leg; the tibialis poſtica, paſſing deep along the back part of the leg; and the peronea, which is the ſmalleſt and leaſt regular artery of the leg, and which has its name from paſſing down behind the fibula. The popliteal artery divides below the ham, under the longer head of the ſolæus muſcle, into two arteries, the tibialis antica, and tibialis poſtica. The tibialis poſtica continues its natural direction downwards under the ſolæus muſcle, and behind the tibia.

ARTERIA TIBIALIS ANTICA.

The tibialis antica makes a ſudden turn forwards, perforates the interoſſeous membrane juſt under the lower edge of the popliteal muſcle; paſſes out towards the fore-part of the leg, betwixt the heads of the tibia and fibula: but ſtill it does by no means become a ſuperficial

perficial artery; on the contrary, it lies deep betwixt the heads of the tibialis anticus and the extenſor of the toes; and is covered here with a very ſtrong faſcia. It is only about ſix inches above the ankle that the leg grows tendinous and naked; there this anterior artery can be felt beating: it lies betwixt the tendons of the tibialis anticus muſcle and that of the extenſor of the toes; it paſſes down along with theſe tendons, through the annular ligament, and over the bones of the tarſus; it ſends one branch acroſs the foot, another forward to the great toe; but the artery itſelf dives betwixt the firſt and ſecond metatarſal bone in the middle of the foot, and ſo gets to the ſole, where it ends in inoſculations with the back arteries.

There is here ſomething like a poſterior recurrent artery; for the tibial artery, before it paſſes out of the ham, gives a ſmall branch which aſcends towards the back part of the joint, and is diſtributed to the heads of the bones, viz. the tibia and fibula, and to the origin of ſome of the muſcles.

ARTERIA RECURRENS.

THERE is here an ANTERIOR RECURRENT, larger than any in the arm, and much reſembling the recurrens interoſſea. It is a branch which comes off from the fore-part of the tibial artery, inſtantly after it has perforated the interoſſeous membrane; it turns immediately upwards under the fleſh of the tibialis anticus; it gives many muſcular branches, ſome to the head of the tibialis, others to the upper part of the extenſor digitorum, and branches go round the head of the fibula to the origin of the long peronæus muſcle. One branch goes directly upwards, and ſpreads all over the lower part of the knee-joint, mixing its branches in the common vaſcular net-work.

The tibialis antica gives no other branch of importance, or which ſhould be named, even from the place of this recurrent quite down to the ankle-joint; for this, like the radial, or femoral, or any long muſcular artery,

artery, continues giving off branches from either hand to the mufcles betwixt which it runs, of equal fize nearly, and all equally unimportant. The tibial artery, then, as it runs down the fore-part of the leg, gives branches to the Tibialus Anticus on one hand; to the Common Extenfor of the toes on the other hand; and to the Extenfor of the great toe, which is the laft of the three mufcles that occupy the fore-part of the leg. It alfo gives little arteries to the tibia, to the fibula, and to the interoffeous membrane which lies betwixt them; but ftill it arrives unexhaufted at the fore-part of the ankle-joint.

But before it croffes the joint (which it does by paffing obliquely along with the tendon of the great toe), it gives out two malleolar arteries, *i. e.* two arteries, one to the outer, and one to the inner ankle.

ARTERIA MALLEOLARIS INTERNA.

THE ARTERY of the INNER ANKLE goes off juft where the head of the tibia begins to bulge. It turns over the inner ankle in many fmall branches; fome mounting upwards along the tibia, but more going downwards over the inner fide of the joint, *i. e.* over the tibia or inner ankle, over the aftragalus, and fome down as low and as far backwards as the heel-bone.

ARTERIA MALLEOLARIS EXTERNA.

THE ARTERY of the OUTER ANKLE goes off a little lower down. It fends fmaller branches upwards round the outer ankle, which go to the Peronæus Brevis mufcle, to the joint, and to the common extenfor of the toes, inofculating round the outer ankle with the fibular arteries. But its chief branch defcends along the fore-part and outer fide of the foot, gives twigs to the fhort extenfor of the toes, and ends in inofculations with the tarfeal arteries, or arteries belonging to the fore-part of the foot.

The arteries which belong to the fore-part of the foot are ufually three in number: One goes off from the tibial

tibial artery a little above the ankle-joint, and is named Arteria Tarſea, becauſe it croſſes the foot over the bones of the tarſus. To this ſucceeds a ſecond about the diſtance of half an inch from it, and which croſſes the foot at the place of the metatarſal bones; it is named Arteria Metatarſea: and the one or other of theſe gives the interoſſeous arteries, accordingly as the one or the other is ſmall or wanting. The third is that remarkable branch which goes forwards along the great toe, whence it is named Arteria Halucis.

ARTERIA TARSEA.

The tasral artery, which is ſometimes of a very conſiderable ſize, almoſt equal to the tibialis itſelf, comes off a little below the ankle, upon the forepart of the foot. It lies upon the ſecond rank of the tarſal bones; it paſſes under the head of the extenſor brevis of the foot; it croſſes the foot obliquely, ſo as to end in the abductor muſcle of the little toe, and in inoſculations with the arches of the ſole of the foot.

This branch gives ſmall inoſculating arteries upwards, which firſt give branches to the joint, and then join with the external malleolar and peroneal arteries. Next it gives branches to the bones and joints of the tarſus, which it lies upon; as the cuboid and cuneiform bones, and their joints. Thirdly, It gives ſmall arteries to the bellies of the extenſor brevis, where it lies under it.

But its greateſt arteries are the interoſſeous arteries, which it ſends along the interſtices betwixt the metatarſal bones. Theſe interoſſeous arteries are three in number; they run along in that interſtice which holds the interoſſeous muſcles; and when they arrive at the end of that furrow, or, in other words, at the place of the forking of the toes, each interoſſeous artery turns down to the ſole of the foot, and goes into the fork of each digital arch, on the loweſt ſide of the toes. Sometimes theſe arteries give alſo ſmall dorſal arteries to the backs of the toes.

The tibial artery having proceeded along the tarſal bones,

bones, and arrived at the lower heads of the metatarſal bones, and having firſt given off ſome trivial branches to the joints of the foot on its inner ſide, and to the bones and muſcles about the root of the great toe, next gives off a metatarſal artery *.

ARTERIA METATARSEA.

THE ARTERY of the METATARSUS or inſtep goes off at the head of the firſt metatarſal bone. It bends acroſs the roots of the metatarſal bones to the root of the little toe; and it diſtributes branches to the tendons of the peronæi muſcles, and ends in the abductor of the little toe, and in the ſkin over the outer edge of the foot. But ſometimes it is a larger and more important artery; for when the tarſal artery is ſmall or wanting, this metatarſal one gives off the interoſſei, and ſupplies its place.

DORSALIS EXTERNA HALUCIS.

THE third branch is the ARTERY of the BACK of the GREAT TOE. This artery is of very conſiderable ſize; it gives no muſcular branches, becauſe it lies upon the bony part of the foot; it runs all along the metatarſal bone which ſupports the great toe; and it ends at the forking of that toe in two great branches; one the dorſal artery of the great toe, which goes along it to the point; another to the ſide of the toe next the great toe, which it alſo runs along, ſomewhat like the forking arteries of the thumb and fore-finger.

The anterior tibial artery ends here (*i. e.* where it gives off the artery of the great toe). By ſinking in betwixt the metatarſal bones of the great toe and of the toe next to it, and going directly into the arches of the ſole of the foot, it produces a great and important anaſtomoſis, ſimilar to that of the radial and ulnar arteries.

* N. B. Betwixt the tarſal and metarſal artery, there is uſually a ſmall branch going outwards to the outer edge of the foot, *i. e.* in the ſame direction with both theſe arteries, but very ſmall.

ARTERIA TIBIALIS POSTICA.

THE POSTERIOR TIBIAL ARTERY is ſo named from its paſſing along the back part of the tibia. The anterior tibial artery paſſes through the interoſſeous membrane only at the lower edge of the popliteal muſcle: this artery comes off from the general trunk at the upper edge of the popliteal muſcle, and paſſes obliquely towards the inſide of the tibia, to take its place behind that bone. Its whole ſituation and general courſe is this: It lies over the tibialis poſticus and flexor muſcles; it lies under the bellies of the gaſtrocnemius and ſolæus; it turns round the inner ankle cloſe upon the bone. Having paſſed the lower head of the tibia, it goes down along the inſide of the heel-bone, in its deep arch, upon which the body is ſupported; it divides at the heel-bone, and advances along the ſole of the foot in two great branches; one running along the ſole, next the outer edge of the foot; the other along the inner edge of the foot; whence they are named external and internal plantar arteries. From this arch the artery gives branches to all the toes, and ſo it ends.

This poſterior artery is chiefly a muſcular one, at leaſt in its courſe down the leg; and though it gives many branches as it paſſes along, there are hardly any worthy of being deſcribed: and from the knee to the ankle-joint there is one only which needs be diſtinguiſhed by name, viz. the artery which nouriſhes the tibia.

Firſt, The tibialis poſtica often gives arteries to the heads of the gaſtrocnemii muſcles; next it gives off the ARTERIA NUTRITIA TIBIÆ, which begins a little below the lower edge of the popliteal muſcle, runs downwards along the interoſſeous ligament, gives muſcular branches to the popliteus, ſolæus, and tibialis poſticus, and then ſends the nutritious artery into the great hole in the middle of the tibia. It gives many branches to the perioſteum of the tibia, and to the interoſſeous membrane

membrane all down the leg, and it ends near the lower end of the tibia in inoſculations with the peroneal artery.

Other nameleſs muſcular arteries ſucceed to this, going to the tibialis poſticus, to the flexor communis, and to the flexor of the great toe. When the artery arrives near the ankle-joint, it gives many ſmall twigs to the perioſteum, tendons, ſheaths, and burſæ mucoſæ behind the ankle; and then paſſing in the very deepeſt part of the ankle, under the annular ligament, and betwixt the tibia or proceſs of the inner ankle and the heel-bone, it adheres cloſely to the bones and capſule of the joint; and there gives a great many little tortuous arteries, making net-works over this joint and its bones, as over the other joints already deſcribed. But eſpecially two delicate arteries go out at this hollow at the ſide of the heel-bone: one forwards towards the ſide of the ankle-joint, the other downwards and backwards over the heel-bone, which ramify very profuſely and very beautifully.

The artery now lying deep under the abductor magnus of the great toe, which ariſes from the heel-bone, forks into its two great branches, the external and internal plantar arteries.

ARTERIA PLANTARIS INTERNA.

The internal plantar artery is much the ſmaller branch, not to be compared in importance (though their names are contraſted) with the external plantar artery; and it is named internal, becauſe as it runs along the ſole of the foot it keeps to the inner edge, viz. that to which the great toe belongs. It comes off under the head of the abductor of the great toe, and under the belly of that muſcle, and cloſe upon the bone; its branches run forwards, quite up to the root of the toe, all along its metatarſal bone. The internal plantar artery has in general four branches, which all run pretty nearly in the ſame direction, viz. ſtraight forwards.

It gives, while under the head of the abductor, ſmall branches, which go backwards to the joint, its capſule, and tendons, and ſome into the ſpongy ſubſtance of the heel-bone; ſome alſo to the ſhort flexor of the foot, and to the maſſa carnea. But its four greater and more regular branches are theſe:

The firſt lies nearer the inner edge of the foot; is the largeſt and moſt conſiderable; it runs along under the inner border of the abductor; it goes quite up to the ball of the great toe, and unites with the proper artery of the toe. As it goes along it gives ſmall twigs to the perioſteum and bone.

The ſecond reſembles the former, except that it does not come off ſo early by two inches; it is of courſe ſhorter, but it paſſes along in the ſame direction, only a little diſtant from the firſt, lying along the middle of the metatarſal bone. It alſo advances up to the root of the great toe, and runs alſo into the proper artery of the great toe (which comes from the external plantar branch), ſo as to enlarge and ſtrengthen it.

The third lies ſtill nearer to the centre of the foot, and deeper among the muſcles. It runs the ſame general courſe, viz. along the ſide of the metatarſal bone up to the ball of the great toe, and ending like the others in the artery of the great toe; but as it lies deeper, it gives branches to the ſhort flexor, to the tendons, and to the inner ſurface of the aponeuroſis plantaris, forming a ſort of ſuperficial arch.

From theſe three arteries, much of the ſkin on the ſole of the foot has its branches.

The fourth and laſt branch of the plantaris interna, is one which goes down deep into the centre of the foot; it lies cloſe upon thoſe ligaments which bind together the bones of the tarſus, and under all the tendons, except thoſe of the tibial muſcles which are like ligaments to the bones. Its deſtination is chiefly to the tarſal joints and capſules; its inoſculations with the external plantar artery can be of no importance.

PLANTARIS EXTERNA.

THE EXTERNAL PLANTAR ARTERY is the great artery of the ſole of the foot, from which the arches of the foot and the inoſculations with the anterior tibial artery are formed.

It turns outwards towards the outer edge of the foot; it runs its great circle round by the metatarſal bone of the little toe; and its plantar arch, or the arch of the ſole of the foot, paſſes over the middle of all the other metatarſal bones. It receives the anterior tibial artery under the middle of the metatarſal bone of the great toe. It is this great curve of the artery turning round in the ſole of the foot that we name the plantar arch; and it is from it that all the proper arteries of the toes ariſe, expreſsly after the ſame order in which the fingers receive their arteries.

The great or external plantar artery lies deep, but not upon the naked bones like the former. It paſſes through betwixt the heads of the ſhort flexor and maſſa carnea; it turns its firſt turn outwards, till it gets under the flexor and abductor of the little toe; then it turns inwards towards the centre of the foot, and lies under the tendons of the long muſcles, and over the metatarſal bones and their interoſſeous muſcles.

Firſt it ſends a large branch backwards to the heel-bone, which belongs entirely to that ſpongy bone, forms, like all ſuch arteries, a ſort of net-work over all the ſurface of the bone; it firſt touches the bone under its extreme point, or that which reſts upon the ground; and it goes branching over it ſo high as to inoſculate round the ankle with twigs of the tibialis antica; it gives branches alſo hereabout to the great ligament of the heel-bone. The external plantar artery next gives branches to thoſe muſcles betwixt which it lies imbedded, viz. the maſſa carnea and flexor brevis; then advancing to the ſide of the flexor digiti minimi, it gives out two or three branches, which firſt go into the fleſh of the abductor and flexor of the little toe, and then turning over the edge of the foot, terminate in inoſculations

oſculations with the arteries of the fore-part of the foot and in the ſkin.

It then begins from the root of the metatarſal bone of the little toe to form that great circle which is named the arch of the foot, and which gives out two ranks of arteries: Firſt, Of interoſſeous arteries going to the ſpaces betwixt the metatarſal bones, upon which the toes ſtand; and, ſecondly, The proper arteries of the toes themſelves.

The firſt of theſe arteries proceeding from the tarſal arch is a ſmall one, the artery of the little toe. It begins at the lower head of the metatarſal bone, lies under the flexor and abductor muſcles, gives branches to theſe muſcles and to the ſkin, and to the bone itſelf; it runs up the outer edge of the little toe, and this is immediately ſucceeded by the firſt interoſſeous artery; which lies deeper, paſſes along the firſt interoſſeous ſpace, gives branches to the bones and interoſſeous muſcle, and inoſculates betwixt the toes with the branches of the anterior tibial artery.

The next artery is properly the firſt of the great arch. It is what is called the RAMUS DIGITALIS, or proper artery of the toes. It is a long artery, runs over the interoſſeous ſpace lying upon the interoſſeous muſcles; it advances to the root of the little toe, and like thoſe of the fingers divides into two branches, one to the inner ſide of the little toe, and the other to the ſide of the toe next it.—A ſecond and a third DIGITAL ARTERY go out in the ſame manner, and ſplit at the roots of the toes into two branches, and with ſo little variety that it is needleſs to deſcribe each part.

In the interſtices of each of theſe arteries lie two or three ſmall perforating arteries, which perforating betwixt the metatarſal bones inoſculate with the interoſſeous arteries which lie on the fore-part of the foot.

But the great external plantar artery, while it is giving out theſe arteries alternately, *i. e.* large branches to the toes, and ſmaller twigs to the interoſſeous muſcles, and ſome ſmaller ſtill which go off from the concave part of the arch, and go into the ſole of the foot to the

ligaments and joints; the great artery goes ſtill onwards, and completes its arch at the middle of that metatarſal bone which ſupports the great toe. There, a little behind the ball of the great toe, it receives the tibialis antica, which perforates from the fore-part of the foot. This completes the arch of the anterior and poſterior arteries, and permits the blood to paſs, according to the preſſure or other accidents, in either direction; and this union ſtrengthens and enlarges the artery of the plantar arch ſo much, that it is not exhauſted by the many branches which it has given off, but gives at this point the largeſt artery of all, viz. the artery which ſupplies the great toe and one ſide of the toe next it. This artery of the great toe is the very laſt or extreme branch of the aortic ſyſtem. It very cloſely reſembles the great artery of the thumb; it gives out three chief branches, viz. one to each ſide of the great toe, and one to the inner ſide of the toe next it. This ARTERIA POLLICIS PEDIS ſometimes ſeems to proceed entirely from the perforating branch of the anterior tibial artery; at other times it ariſes fairly from the plantar arch.

ARTERIA PERONEA.

THE FIBULAR ARTERY, or the third artery of the leg, which is much ſmaller than theſe two, is to be regarded rather as a branch of the anterior tibial artery; and in its courſe and connections, and its being exhauſted nearly by the time it reaches the ankle-joint, it greatly reſembles the interoſſeous of the fore-arm, which ſtops below the wriſt, or paſſes it only with ſmall and extreme branches.

Where the tibialis antica paſſes through the interoſſeous ligament, the arteria peronea breaks off from it, almoſt of equal ſize with itſelf, and paſſes down behind the fibula, whence it has its name. It ariſes near the head or origin of the tibialis poſticus muſcle, and accompanies that muſcle down to the ankle-joint, lying betwixt it and the flexor of the great toe.

This is entirely a muſcular artery for ſupplying thoſe deeper parts which the other arteries do not ſupply. Its branches, like thoſe of all muſcular arteries, are extremely irregular; its chief branches are to the ſolæus, to the peronæi muſcles, to the tibialis poſticus, to the flexor of the great toe. Several little arteries turn round the fibula from point to point, going to the fore-part of the leg. All the way down the leg, it is giving off repeated branches to the ſame muſcles; and in this courſe it gives ſome little arteries, which pierce through the interoſſeous membrane, and alſo gives the nutritious artery of the fibula.

When it approaches the ankle-joint, the fibular artery gives off an anterior branch, which perforates the interoſſeous membrane, paſſes through betwixt the tibia and fibula nearly where they are joined; it turns downwards over the outer ſide of the ankle, by the extenſor pollicis and peronæus brevis tendons. This is named PERONEA ANTERIOR, though it is an artery of little importance. Its branches are given not to muſcles, for this is a naked and bony part of the foot; but are expanded upon the lower heads of the tibia and fibula, and upon the os cuboides. They nouriſh the tendons, ligaments, and burſæ of the outer ankle; they end in inoſculations with the malleolar artery, from the tibialis anterior, and with the tarſal artery.

ARTERIA PERONEA POSTERIOR.

As this ANTERIOR FIBULAR ARTERY branches over the fore-part of the outer ankle, the POSTERIOR FIBULAR ARTERY paſſes deep behind the ſame ankle, and is juſt the continuation of the main artery; which having paſſed down behind the acute angle of the fibula, ſinks into that deep hollow which is behind it upon the ſide of the heel-bone. Behind the tibia the artery makes large inoſculations with the poſterior tibial artery, and gives many branches to the tendons. Branches alſo turn round the ankle, making a net-work of veſſels upon it, and inoſculating with the anterior tibial artery.

 It

It continues to give the ſame ſmall arteries to the outer ankle, to the peronæi tendons, to the outer ſide of the heel-bone, and to the abductor of the little toe. It ends uſually in that muſcle, and in inoſculations with that branch of the external plantar artery which turns backwards upon the heel-bone and ramifies upon it ſo beautifully.

These are the laſt branches of the three great arteries of the leg and of the aortic ſyſtem.

DESCRIPTION

OF

THE VENOUS SYSTEM.

CHAP. I.

OF THE VEINS IN GENERAL.

THE veins are the veſſels by which the blood carried outward by the arteries is returned to the heart. The ſyſtem of the veins, however, is not ſo ſimple as that of the arteries, for while there are only two great arteries carrying the blood from the heart, viz. the aorta and the pulmonic artery, there are three great trunks of the veins, viz. the ſuperior and inferior vena cava, the trunks of the great veins of the body; the pulmonic vein, which returns the blood to the heart from the circulation through the lungs; and the vena portæ, which collects the blood of the inteſtines, and conveys it to the liver. There are beſides, a greater variety in the diſtribution of the veins, than in that of the arteries.

The French phyſiologiſts have departed from the old method of Harvey, in explaining the circulation. He wiſely took the heart as the centre of the ſyſtem, and deſcribed the veſſels going out from it, forming the two circulations, viz. through the body and through the lungs; but they have aſſumed the lungs as the centre; and the veins of the body, and the arteries of the lungs, they call *ſyſteme à ſang noir*, becauſe it contains the dark-coloured blood; and the pulmonic veins and the arterial ſyſtem of the body, they call *ſyſteme à*

ſang

ſang rouge, becauſe it conveys blood of the bright vermilion colour.

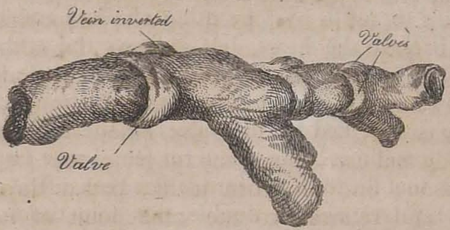
This conceit is perhaps admiſſible, when introduced as an additional illuſtration of the relation of the lungs to the body; but it cauſes in a difficult ſubject an unuſual degree of intricacy, and does not ſerve the purpoſe of demonſtration: beſides, the arteries and veins of the body, and the pulmonic artery and vein, have that ſtrict and mutual dependance in action, which ſhews how improper and how unnatural it is to make this change, and to ſeparate them in explaining the general ſyſtem. At all events, let thoſe who adopt this novelty ceaſe to ſpeak of the two circulations, for although in regard to the heart, there are two circulations, yet as the movement of the blood reſpects the lungs, there is only one. By this diviſion, the blood returning from the body and carried into the lungs, cannot be called a circulation; but only when it has paſſed through the lungs, and returned to the ſame point of its courſe through the body.

I retain the old method, correſponding with what has been delivered in the preceding volume, and in deſcribing the veins will follow the courſe of the blood through them.

GENERAL CHARACTER OF THE VEINS.

THE capacity of the veins is greater than that of the arteries; the coats are thinner but ſtronger comparatively, and admit eaſily of dilatation to a certain extent. The coats of the leſſer veins are comparatively ſtronger than thoſe of the larger ones, and the veins of the lower extremity much thicker and ſtronger than in the upper parts of the body, as they have to bear a higher column of blood. The veins are tranſparent and the blood is ſeen through their coats. There can be properly diſtinguiſhed, only two coats in the veins: the outer coat, which is floculent and cellular without, to connect with the ſurrounding parts, ſmoother and more compact within, where it is united with the inner coat. In it are ramified

ramified the vaſa vaſorum; and a fibrous ſtructure is to be obſerved in ſome of the larger and ſuperficial trunks; theſe ſtriæ or fibres run longitudinally *. The inner coat is firm and compact and intimately united to the other; it is ſmooth, flexible, and formed into valves in various parts; which valves are ſemi-lunar, and reſemble thoſe in the root of the great arteries in the heart.



In all the larger veins, excepting thoſe of the viſcera of the abdomen, and thoſe of the lungs and brain, there are valves; but in the ſmaller veins there are no valves: theſe valves conſiſt of the inner coat, forming folds like a curtain, hung acroſs the calibre of the vein; but at the ſame time attached ſo obliquely to the ſide of the vein, that they preſent a ſacculated membrane to receive the refluent blood. The looſe margin of the valve is ſomewhat ſtronger than the other part, and betwixt the duplicature ſome ſplendid little filaments are ſometimes obſerved. Each valve conſiſts, in general, of two ſemi-lunar membranes, the margins of which, falling together, prevent the blood from paſſing retrograde; but they yield and give freedom to the current of blood when flowing towards the heart.

* Unleſs near the auricle no muſcular fibres have been obſerved. See *Halleri Opera Minora*, p. 175.

Authors

Authors have not noticed a part of the ſtructure eſſential to the operation of a ſemi-lunar valve. I mean the little ſinuſes or more dilatable part of the coats of the veins juſt above the attachment of the valve. Theſe ſinuſes are of the ſame uſe here that they are in the origin of the great arteries from the heart. The blood running back dilates them, and thus catches the margin of the valve and throws it down. Without this proviſion, the valve being collapſed to the ſide of the vein, the blood might be permitted to paſs retrograde.

A ligature high on the arm or thigh not only cauſes the veins to ſwell by preventing the free courſe of the blood back to the heart, but it ſhews the veins in their diſtinct and natural character, and cauſes the ſinuſes of the valves to riſe, ſhewing the places of the valves.

The ſacs formed by the valves of the veins are much deeper ſometimes than the term ſemi-lunar implies, inſomuch that the term pyriformis has been uſed. Neither are the valves always double, for ſometimes they are ſingle, and ſometimes three in number *. They are beſt ſeen by opening the veins under water.

As the veins are provided with valves only where they are expoſed to occaſional preſſure, and particularly to the compreſſion of the muſcles; the uſe of the valves would ſeem to be, to prevent the retrograde movement of the blood, in conſequence of the occaſional compreſſion of the veins; but no doubt, they at the ſame time ſupport the column of blood, as in the lower extremities: and when thoſe veins ſuffer diſtention by diſeaſe, a great aggravation is, that the valves loſe their action, for the vein is now too large to be cloſed by them, and the whole column of blood preſſes upon the veins of the legs.

Fabricius ab Aquapendente, who diſcovered the valves of the veins, though ignorant of the circulation, and of the true uſe of the valves conſequently, yet argues very ingeniouſly; for he imagined that exerciſe by heating

* Fabricius de Venarum Oſteolis. Morgagni Epiſt. Anatom. XV. Kerckringii Spicilegium Anatomicum, Tab. 4.

the

the limbs would draw the blood from the trunk, to the injury and rupture of the veſſels of the limbs, and the too great diminution of nouriſhment in the vital parts, were it not for the office of theſe valves.

The commencement of the minute branches of the veins, is from the extreme ramifications of the arteries; they are continuous, and convey back the blood in that courſe which is called the circulation. In contemplating the capillary tiſſue of veſſels, the moſt ſtriking circumſtance is, the predominance of the dark venous ramifications: and in general two ſets of veins will, even in theſe minute ramifications, be obſerved; one ſuperficial, the other more intimately blended with the minute ramifications of the arteries; but in the internal parts of the body, and particularly the viſcera, the veins uniformly accompany the ramifications of the arteries, and in the ſolid viſcera, a denſe cellular membrane gives lodgment to both ſets of veſſels.

In the extremities and head, indeed every where but in the viſcera, the veins form two diſtinct ſets; the deep and the ſuperficial veins: the deep veins accompanying the arteries; and the ſub-cutaneous veins, which emerge from the compreſſion of the muſcles, and run above the faſcia. The union betwixt the branches of the veins, is very frequent, not only betwixt the veins, ramifying in the ſame plane in ſo much as to make them a mere net-work; but alſo betwixt the deep and the ſuperficial ſet of veins: ſuch are the venæ emiſſariæ of the ſkull, the free communications betwixt the external and internal jugular vein, betwixt the deep and ſuperficial veins of the arm, &c. When in bleeding, the blood flows from the vein of the arm, accelerated by the working of the muſcles, the blood eſcapes by the anaſtomoſis, from the compreſſion of the muſcles, and fills the ſuperficial veins; but the increaſe of the jet of blood, is principally produced by the ſwelling of the muſcles, cauſing the faſcia to compreſs the internal veins of the fore-arm.

In the dead body the veins are flat, but when diſtended, they reſume the cylindrical figure which they

poſſeſſed

poſſeſſed in the living body; yet they are in general of the cylindrical figure for a very ſmall part of their courſe only, owing to the irregular dilatations by the ſide of the valves, or by the frequent union of their branches. The manner in which the branches join the trunk, has a peculiarity which always diſtinguiſhes them from the ramifications of arteries: the arteries branch direct and at an acute angle, the veins in a direction more removed from the courſe of the trunk, and in general with a curve or ſhoulder.

In infancy and youth, the veins are little turgid, and eſpecially the cutaneous veins are ſo firmly embraced by the elaſtic ſkin and cellular membrane, that they have a leſs degree of prominency than in more advanced years. In old age, the veins are enlarged, and riſe turgid on the ſurface, and the internal veins alſo become enlarged and varicoſe.

Soemmerring ſays, with increaſing years the reſiſting power of the veins is diminiſhing, that of the arteries increaſing *. I believe this to be incorrect in regard to both kinds of veſſels.

I do not conſider the change in the vaſcular ſyſtem, as the effect of mere diſtention, or of the enlargement of the veins, from the long continued action of the arteries; but as a neceſſary change in the proportionate diſtribution of the blood, which is preceded or accompanied with other peculiarities, the character of old age. When we conſider the great ſize of the veins compared with the arteries, we muſt conclude that the blood flows but ſlowly in the venous ſyſtem: that from the narrowneſs of the trunks of the veins near the heart, the blood muſt be accelerated as it approaches the heart; and that receiving the impulſe from the ventricle, it muſt take a rapid courſe through the arteries, until again approaching the extreme branches of the arteries and paſſing into the veins, its motion becomes more languid and ſlow. In youth, as the ſize of the veins is not in ſo great a proportion to the arteries, as in advanced life,

* Vol. v. § ccxxviii.

the

the blood in a young perſon, muſt be in more rapid and quick circulation: but in old age, owing to the largeneſs of the veins and the accumulation of blood in them, the blood moves ſlowly through the venous ſyſtem, and is almoſt ſtagnant in the dilated veins and ſinuſes; upon the whole, it moves leſs briſkly through the veſſels, and the proportionate quantity immediately under the influence of the arterial ſyſtem, is leſs than in youth.

There is no pulſation to be obſerved in the veins, but what they receive laterally from the contiguous arteries. There is no pulſation in the veins, becauſe they are removed from the heart; becauſe they do not receive the ſhock of the heart's action in their trunk, but only by their widely-ſpread branches; becauſe the contraction of the heart, and of the arteries ſo alternate with each other, as to keep up a perpetual and uniform ſtream of blood into the veins; whereas the pulſation in the arteries is owing to the ſudden and interrupted contraction of the heart.

In living animals I have undoubtedly ſeen the courſe of the blood in the great veins near the heart alternately checked and accelerated in its motion. But this is a ſubject which I have no diſpoſition to purſue. This motion does not prove that there is here a muſcular contraction *.

I have diſtinctly ſeen a white fluid in the extremities of the veins of the human inteſtines.

In this general account of the venous ſyſtem, it remains only to ſpeak of the ſubject of abſorption. Before the ſuite of experiments made on this ſubject by Mr. Hunter, a vague notion was entertained that the veins were abſorbents; but about that time †, the doctrine that lymphatics were abſorbents having been eſtabliſhed, the opinion that the red veins were alſo abſorbents, was

* *Haller* found contraction produced in the veins by touching them with oil of vitriol. *Opera Minora*, p. 375.

† 1758.

firſt

firſt queſtioned, and finally confuted, at leaſt in the opinion of moſt phyſiologiſts.

The chief argument to ſhew that veins, ariſing from cavities, particularly from the inteſtines, acted as abſorbents, was, that ſome anatomiſts ſaid they had ſeen white chyle in the blood taken from the meſenteric veins. It was, however, ſoon obſerved that the ſerum of the blood, taken from the veins of the arm, was ſometimes white, which muſt ariſe from ſome other cauſe than the abſorption of chyle *.

The experiments of Mr. John Hunter, proved that there is no abſorption of fluid, from aliment contained in the inteſtinal canal, by the veins of the meſentery, while the lacteals were rapidly abſorbing. Emptying a portion of the gut, and the veins of their blood in a living animal, he poured milk into the inteſtine. The veins remained empty, and without a drop of the milk finding its way into them, while the lacteals became turgid with it. In another experiment, leaving the arteries and veins of the meſentery free, and the circulation through them perfect; ſtill no white fluid could be diſcovered, tinging the ſtream of blood in the veins. Neither did preſſure upon the gut, in any inſtance force the fluid of the inteſtines into the veins.—He repeated and varied theſe experiments, ſo as to ſhew, in a very ſatisfactory manner, that chyle, or the fluid of the inteſtines, never is abſorbed by the veins.

Yet I muſt ſay that theſe experiments are ſtill unſatisfactory, as they regard the general doctrine of abſorption by the veins: in the inteſtines there is a peculiar ſet of veſſels evidently deſtined to the abſorption of the chyle and of the fluids of the cavity; but there remains a queſtion which will not be eaſily determined: do not the veins throughout the body reſume a part of that ſubſtance, or of thoſe qualities, which are depoſited or beſtowed by the blood of the arteries?—Are we aſſured that in the circulation of the blood through the lungs, and in

* See Hewſon, Exper. Eſſays and Lymphatic Syſtem.

extremities of the pulmonic veins, there is no imbibing or abſorption? In the veins of the placenta, there is not only an operation ſimilar to what takes place in the extreme branches of the pulmonic circulation, but the matter and ſubſtance which goes to the nouriſhment of the fœtus, is imbibed from the maternal circulation *. So by the veſſels in the membrane of the chick in ovo, there is abſorbed that which being carried to the chick, beſtows nouriſhment and encreaſe. For my own part, I cannot but ſuppoſe that, while the lymphatics abſorb the looſe fluids which have been thrown out on ſurfaces, or into cavities—the veins receive part of what is depoſited from the arteries; but, which is not ſo perfectly ſeparated from the influence of the circulating ſyſtem, as that which the lymphatics receive; and that there are certain fluids, which, by an affinity of the venous blood they imbibe in the courſe of the circulation. We muſt at the ſame time acknowledge, that the concluſions made in favour of abſorption by veins, from experiments upon the dead body, are fallacious, and have no weight.—It is ſeldom we can determine whether minute injections have taken a courſe by a natural, or by a forced paſſage: neither are the experiments of ſome of the older phyſiologiſts more ſatisfactory or concluſive. Lower affirmed that, by throwing a ligature on the inferior cava of a dog, he produced aſcites. He tied the jugular veins of a dog, and the head became dropſical. Hewſon repeated theſe experiments, but without the ſame reſult. And if the tying of the veins had always produced œdema or dropſy, the experiment would have proved nothing more than is already eſtabliſhed by the very common occurrence of œdema of the legs, from the preſſure of the womb on the iliac veins, or a tumor in the groin, or in the pelvis. Now in theſe inſtances the compreſſion of the vein does

* Dr. Hunter, Hewſon, &c. ſay that it is probable there are many ſmall lymphatics in the placenta, which open into the branches of the veins, and do not take a courſe along the cord. This is very improbable, and has no ſupport from analogy.

nothing more than cauſe a difficult circulation of the blood, from the extreme arteries into the veins, and conſequently a greater profuſion of the diſcharge into the cellular texture by the ſerous arteries.

SECTION I.

OF THE VEINS, BRANCHES OF THE SUPERIOR VENA CAVA.

THE ſuperior vena cava, or the deſcending cava, is the ſuperior trunk of the venous ſyſtem; which receives the veins of the head, neck, and arms, and throws the blood directly into the great right ſinus, or auricle of the heart.

But I hold it better to begin my deſcription from the extremities of the veins, following the courſe of the blood. I therefore commence with the veins of the forehead.

OF THE VEINS OF THE HEAD AND NECK.

THE ANTERIOR FACIAL VEIN *. The facial, or anterior facial vein, runs down obliquely from the inner canthus of the eye, towards the angle of the lower jaw-bone. Here uniting with the temporal vein, it forms the external jugular vein. The moſt remarkable branches of veins which aſſiſt in forming the facial vein, are the FRONTAL VEINS; which receive the blood from the forehead and frontal portion of the occipito-frontalis muſcle, and the OPHTHALMIC VEIN, which is one of the emiſſariæ, and comes from the cavernous ſinus through the orbit.—In its courſe down the cheek, the facial vein receives the ſeveral cutaneous branches of the

* *Facial vein; V. Angularis; V. Triangularis.*

the veins from the ſurrounding parts: but which have in reality no ſuch importance as to require deſcription *.

THE POSTERIOR FACIAL VEIN †; or, GREAT TEMPORAL VEIN.—This vein deſcends from the temple before the ear, through, or under the maſs of the parotid gland, and behind the angle of the lower jaw.

This poſterior vein receives thoſe branches which are the proper temporal veins, and which are four in number, and deſcend upon the ſide of the head ‡; and thoſe which anſwer to the ſubmaxillary artery, and alſo the vena tranſverſa faciei, and the auricular veins. Finally into ſome of the deep branches of this vein § the blood enters from the veins accompanying the arteria meningea. The poſterior facial vein, uniting with the anterior one, forms a common trunk, which in general lies over the diviſion of the carotid artery.

EXTERNAL JUGULAR VEINS.

THE external jugular vein takes a courſe obliquely down the neck, and acroſs the middle of the maſtoid muſcle. It lies under the fibres of the platyſma myoides muſcle, and drops either into the ſubclavian vein, or into the internal jugular vein. Sometimes there are two external jugular veins on each ſide; more commonly there are two branches high in the neck, from the anterior and poſterior facial veins, which unite about the middle of it. When they are double they have this courſe; the *anterior and external* jugular vein, may be ſaid to begin from the anterior facial vein; it then receives the ſubmental vein, which comes in under the baſe of the lower jaw—the ranine veins alſo, and veins

* *Vena dorſalis naſi, ſuperior et inferior*—*Vena palpebralis inferior externa et interna*—*Vena alaris naſi*—*Venæ labiales magnæ et minores*, &c.—*Venæ buccales*, &c.

† *Joannis Gottlieb Walteri, tab.* ii. 65.—*Venarum Capitis et Colli.*

‡ Being in two ſets, the deep, and ſuperficial. Walter. tab. ii.—*Vena tempor. ſuperf.* 110. *et Vena temp. profund.* 111.

§ *Viz. Venæ Pterygoideæ.*

 from

from the glands under the jaw join it here: where it is before the maſtoid muſcle, it forms free communications with the internal jugular veins; and here alſo, it receives veins from the ſide of the throat *.

Almoſt all the ramifications of veins, which in one ſubject unite to the external jugular vein, and which come from the face and throat, do in others ſink down into the internal jugular vein †.

Sometimes the anterior and external jugular veins join the internal jugular vein; ſometimes the ſubclavian vein.

THE POSTERIOR EXTERNAL JUGULAR VEIN is formed chiefly by the temporal vein, or, poſterior facial vein, which comes down from under the parotid gland; it is then joined by the occipital veins ‡, a little lower by the cervical veins, and laſtly, on the lower part of the neck it receives the muſcular branches from the fleſh of the ſhoulder; it then ſinks into the ſubclavian vein.

OF THE THYROID VEINS.—The thyroid gland has two ſets of veins, as it has of arteries; the *ſuperior thyroid* veins carry back the blood from the muſcles of the fore-part of the throat, from the larynx, from the ſubſtance of the thyroid gland, and from the neighbouring part of the trachea and pharynx, and even from the fauces. Sometimes theſe thyroid veins enter the external jugular vein; ſometimes they deſcend upon the neck, taking the name of GUTTURAL VEINS, and unite themſelves with the internal jugular vein.

THE LOWER THYROID VEINS come from the lower part of the thyroid gland, and deſcend upon the fore-part of the trachea, and enter the ſubclavian; or, more generally, the great, or internal jugular veins.

OF THE INTERNAL JUGULAR VEIN.—JUGULARIS INTERNA §.—VENA JUGULARIS CEREBRALIS ‖.—The

* Viz. The ſuperior thyroid veins, and the deep laryngeal veins.

† Walter loc. cit. tab. ii. 13.

‡ Theſe communicate with the vertebral veins, and through the poſterior maſtoid foramen with the lateral ſinus.

§ Haller. icon.

‖ Walter.

internal

internal jugular vein is formed by the conflux of the ſeveral great and poſterior ſinuſes of the dura mater into the lateral ſinus, which coming out by the foramen lacerum poſterius of the baſis cranii, ceaſes to be conſtricted into the triangular ſhape, and takes the form and peculiarities of a vein. From this foramen, common to the temporal and occipital bone, the jugular vein deſcends obliquely forward and downward, becoming from its deep ſituation ſomewhat more ſuperficial, but in all its extent protected by the ſterno-cleido-maſtoideus muſcle, and paſſes under the omo-hyoideus muſcle. The internal jugular vein is very irregular in its form; being ſometimes much contracted under the angle of the jaw; bulging and much enlarged, or rather capable of being much diſtended in the middle of the neck; and again contracted before it joins the ſubclavian vein. The carotid artery, the internal jugular vein, and the par vagum lie together in the ſame ſheath of looſe cellular membrane. The vein is to the outſide of the artery, and the nerve is betwixt them.

The internal jugular vein receives theſe communications and branches; behind the angle of the lower jaw, a branch of communication generally goes down from the poſterior facial vein, and often it is joined by the internal maxillary vein: under the jaw, it either forms free communications with the beginning of the external jugular vein, or it receives the ranine and guttural veins; at all events, there is a branch from the ſide of the throat, and the muſcles of the os hyoides which paſſes into the internal jugular vein. From under the back part of the maſtoideus muſcle, it receives branches from the occipital veins, and forms communications with the vertebral veins. Near its termination the great jugular vein receives the guttural and lower thyroid veins.

Of the vertebral veins.—There is difficulty in aſſigning origins to theſe veins, for they are rather like a chain of communication; they run in the holes of the tranſverſe apophyſis of the cervical vertebræ, and ſurround the proceſſes with areolæ. Firſt, a communica-

 tion

tion is formed with the great lateral ſinus, then they receive the flat ſinuſes from under the dura mater, covering the cuneiform proceſs of the occipital bone, (the baſilar ſinuſes) and as they deſcend they form tranſverſe communications, which receive the branches of that chain of inoſculations, which runs down upon the ſpinal marrow. The vertebral veins, in their deſcent, ſend out diviſions which run down upon the outſide of the canal, and receive branches of veins from the muſcles on the fore-part of the vertebræ, and ſome of the proper cervical veins from behind. The *vena cervicalis* coming from the ſide of the neck, unites with the vertebral vein near its termination, in the back part of the ſubclavian, or ſometimes in the axillary vein.

SECTION II.

OF THE VEINS OF THE ARM.

THE veins of the arm are in two ſets, the venæ comites; and the external or ſub-cutaneous veins, being thoſe without the faſcia, and not ſubject to the compreſſion of the muſcles. Of theſe, the latter are the more important and require a particular deſcription.

On the palm of the hand, the veins are few and ſmall, becauſe they are there ſubject to compreſſion in the frequent graſping of the hand; but on the back of the hands and fingers, the veins are numerous and large. The veins creeping along the fingers, make a remarkable inoſculation on the back of the firſt phalanges, and then paſſing in the interſtices of the knuckles, form a great and irregular plexus on the back of the hand *: the principal branch of which ſometimes takes the form of an arch †.

* *Plexus dorſalis manus.* † *Arcus venoſa dorſalis.*

The

The plexus of veins from the back of the hand is continued over the back of the wrist: when some of the larger branches, after playing over the heads of the radius and ulna, take a course, the one on the lower, and the other over the upper edge of the arm, whilst the back of the arm is left without any remarkable veins taking their course there.

The veins on the back of the hand have nerves intermingling with them, viz. branches of the ulnar nerve, and the extreme branches of the muscular spiral nerve; so that it is a great mistake to suppose that bleeding in the back of the hand might be substituted with advantage for the common operation in the bend of the arm, in order to avoid pricking the nerves.

VENA CEPHALICA.—The vein of the back of the thumb running into a trunk, which takes a course over the outside of the wrist, is called CEPHALICA POLLICIS.

From this vein and the division of the plexus of the back of the hand, a considerable trunk is generally formed, which takes its course on the radial edge of the arm, and is called CEPHALICA MINOR, or RADIALIS EXTERNA. This vein in its tract over the extensor radialis, and the supinator longus, has many lateral communications, particularly with the median vein.

This vein, now joined by the median cephalic, and rising upon the outside of the humerus, is the GREAT CEPHALIC VEIN; and it passes, first betwixt the biceps and triceps brachii, and then betwixt the deltoides and pectoralis major muscles. Several small cutaneous veins play over the belly of the biceps muscle, and communicate with the basilic vein; a little below the external condyle of the os humeri, the cephalic vein detaches a branch which ascends betwixt the brachialis internus and supinator longus, and which afterwards forms inosculations with the basilic vein, on the back of the arm.

The great cephalic vein passing up betwixt the tendons of the pectoralis major and the deltoid muscles, sinks into the axilla and joins the axillary vein.

VENA BASILICA *. We trace the origin of the bafilic vein from thofe veins which, being continued from the plexus, on the back of the hand, take their courfe over the lower head of the ulna. (A confpicuous branch of thefe veins, from the little finger, was called SALVATELLA † by the ancients.) From this origin, the bafilic vein takes a fpiral courfe on the ulnar edge of the fore-arm, fometimes in one great trunk, oftener in two, fometimes in a plexus of veins; here it may be called ULNARIS SUPERFICIALIS, or CUBITALIS INTERNA. This vein, now rifing before the inner condyle of the humerus, paffes on the inner margin of the biceps flexor mufcle; here it forms very free and numerous connections with the internal or brachial vein, the fatellites and cephalica; now paffing up, until it finks by the outfide of the tendon of the pectoral mufcle, it joins the axillary vein.

The great bafilic vein, or the great trunk, after it has afcended above the elbow, and received the median bafilic, is joined by feveral deep branches of veins, as thofe which accompany the brachial artery, called fatellites or comites, a vein which is called profunda brachii; and ftill nearer its termination, it receives the addition of the *vena fub-humeralis*, or *articularis*, and the *venæ fcapulares*, viz. thofe anfwering to the arteries of that name.

VENA MEDIANA MAJOR ‡.—This is a vein which runs up the middle of the fore-arm, beginning from the plexus of veins, which play over the flexor tendons, and come from the ball of the thumb; it is a vein which is very irregular, being fometimes double, and fometimes rather in the form of a plexus, than to be con-

* *Brachialis.* The ancients termed the bafilic vein of the right arm, the vein of the liver, or *vena hepatica brachii*, and that of the left, the *vena fplenica brachii*.

† *Salvatella quafi Salvator* being opened as a fovereign remedy in Melancholia.

‡ *Vena Media; vena fuperficialis communis.* *Fabricii fig. brachii viva.*

fidered

ſidered as a regular trunk; often it is particularly ſhort, and can be conſidered as a trunk, only for a few inches as it approaches the bend of the arm; not unfrequently it is entirely wanting, and, as if annihilated by the greater ſize of the branches of the cephalic or baſilic veins. But, for the moſt part, when this vein has aſcended on the middle of the fore-arm, near to the bend of the arm it divides; one branch paſſes obliquely outward, and joins the cephalic vein, the other inwards and unites with the baſilic vein; the firſt is of courſe the MEDIAN CEPHALIC VEIN *, the ſecond, the MEDIAN BASILIC VEIN.

Theſe are the two branches which the ſurgeon moſt commonly ſelects for bleeding. Around the median cephalic, the cutaneous nerves play more profuſely, and under the median baſilic vein the humeral artery paſſes. It is by the awkward plunging of the lancet into the median baſilic, that the country bleeder ſometimes produces the aneuriſm of the artery; but the dreadful ſymptoms following the pricking of the nerve, are more frequently produced by bleeding in the median cephalic; caſes however occur of the pricking of the nerves, while bleeding in the median baſilic vein.

AXILLARY VEIN.—The trunk of the veins of the arm paſſes through the axilla, until it arrives betwixt the firſt rib and clavicle, under the name of axillaris. Here lying by the ſide of the artery, it receives many muſcular branches from the fleſh of the ſhoulder, the external and internal ſcapular veins, and the thoracic veins; in general where it paſſes by the head of the humerus it receives the cephalic vein.

SUBCLAVIAN VEINS.—The axillary vein continuing its progreſs over the firſt rib, becomes the ſubclavian vein, and is joined by the external jugular vein. It then takes a direction downward, and being joined by the great internal jugular vein, and having received the trunk of the abſorbent ſyſtem juſt at the angle of the

* *Portio cephalica, A. B. loc. cit.*

meeting

meeting with the great jugular vein, it terminates in the ſuperior cava. On the right ſide the ſubclavian vein is ſhorter, and deſcends more directly; on the left it is longer, but ſtill its direction is downward and acroſs the upper part of the cheſt; paſſing before the trachea and the branches of the arch of the aorta, it joins the ſubclavian of the right ſide, and together they form the ſuperior cava. Beſides the jugular veins, the left ſubclavian vein receives theſe, a vein from the ſhoulder and lower part of the neck, the vertebral vein, with ſome leſſer plexus of veins deſcending from the neck, and the thyroid veins. From below they receive the leſſer internal thoracic veins, and the mammariæ *.

SECTION III.

THE SUPERIOR VENA CAVA, THE VENA AZYGOS, AND LESSER VEINS OF THE THORAX.

The ſuperior vena cava is the trunk of all the veins of the head, neck, arms, and of the parts in the thorax; ſoon after it is formed by the ſubclavian veins, it is joined by the vena azygos, and receiving the INTERNAL MAMMARY VEINS, and the VENÆ THYMICÆ, and PERICARDIAC branches, the INTERCOSTAL and BRONCHIAL veins, it deſcends into the pericardium, and dilates or opens into the right ſinus or auricle.

VENA AZYGOS †. This is the principal vein of the thorax, and chiefly of the walls of the thorax. It is obſerved to take its origin upon the vertebræ of the loins from ſome of the lumbar veins, or by inoſculations with the renal, ſpermatic or leſſer branches of the abdominal cava, receiving the firſt and ſecond lumbar veins, as in its aſcent in the thorax, it receives the intercoſtal veins on

* *Haller, Icon. Anatomic. Corporis humani Faſciculus* III. *tab. arter. Pectoris.*

† *Sine pari.*

on either ſide * ; aſcending betwixt the crura of the diaphragm, and by the ſide of the aorta, it ſometimes receives the lower phrenic veins ; in the thorax lying on the right ſide of the bodies of the vertebræ, and before the intercoſtal arteries, it receives the bronchial veins from the root of the lungs, and from the trachea it receives the veins of the poſterior mediaſtinum and œſophagus ; through the intercoſtal veins, it communicates with the external and internal mammary veins, and with the venal circles of the ſpinal marrow.

Upon the third vertebra, the azygos vein ſeparates from the ſpine, and with an arch, and bending round the root of the lungs, it opens into the ſuperior cava, juſt where it is about to enter the pericardium : where it opens into the great vein, it is guarded by a valve.

This vein however, like moſt others, has conſiderable variety, and does not always merit the name of azygos, for ſometimes it is double, a diviſion aſcending on the left ſide of the ſpine, and uniting with the branch of the other ſide, juſt as it is about to enter into the ſuperior cava.

OF THE LESSER VEINS IN THE THORAX.—The VENÆ MAMMARIÆ take a courſe by the ſide of the internal mammary artery, and require no deſcription. Like the arteries, they ſpread their branches on the muſcles of the belly, and communicate with the diaphragmatic and lumbar and epigaſtric veins. The left mammary vein terminates in the left ſubclavian vein, the right in the ſuperior vena cava.

THE VENÆ THYMICÆ enter, either into the union of the ſubclavian veins, or they enter into the guttural veins, or the internal mammary veins.

THE PERICARDIAC VEINS gather their branches from the pericardium, from the aorta, trachea, and lymphatic glands ; they ſend down branches by the ſide of the phrenic nerve, which inoſculate with the veins of the diaphragm ; they enter the internal mammary vein, or

* We except ſome of the veins from the interſtices of the higher ribs, particularly on the right ſide, which enter the ſubclavian vein.

the

the ſuperior cava, or the terminations of the right ſubclavian.

THE SUPERIOR INTERCOSTAL VEINS.—The right and left intercoſtal veins differ in their ſize and diſtribution; the right is ſmall, and receives only one or two of the upper intercoſtal veins, which do not enter into the azygos vein. The vein of the left ſide begins even ſo low as the interſtice of the ſeventh rib; it receives branches from the pleura, pericardium, and lungs (viz. the bronchial veins) and from the œſophagus; they enter the ſubclavian veins.

CHAP. II.

OF THE VEINS WHICH UNITE TO FORM THE INFERIOR VENA CAVA.

THE inferior vena cava receives the veins of the lower extremities, the hypogaſtric and abdominal veins, and the veins of the viſcera of the abdomen; but thoſe of the membranous contents of the abdomen are received by it only indirectly, and through the circulation of the liver.

OF THE VEINS OF THE LEG AND THIGH.

WE have obſerved that the veins of the extremities are in two ſets; the deep and ſuperficial. In the leg and thigh, the deep-ſeated veins accompany the arteries, and receive the ſame name: the cutaneous veins are the ſaphena major and minor.

SAPHENA MAJOR *.—A large and beautiful plexus of veins is formed on the fore-part of the foot, and coming from the back of the toes, and outſide of the foot. Two principal veins ariſe from the arch which theſe form: one takes the courſe behind the inner ankle, and

* *Saphena magna, interna.*

is

is the ſaphena major; the other paſſes over the outer ankle, and forms the ſaphena minor.

The great ſaphena may be traced from the great toe, from the inſide of the foot, and behind the ankle: it receives one or two branches from the ſole of the foot. Sometimes the principal branch paſſes behind the lower head of the tibia, ſometimes before it, or it forms circles here: a little above the ankle a vein from the middle of the metatarſal arch comes obliquely over the tendon of the tibialis anticus, and joins it.

The ſaphena, now a conſiderable trunk, runs up the leg before the inner margin of the belly of the gaſtrocnemius muſcle, and on the inner ridge of the tibia. In this courſe it receives numerous cutaneous branches, and backward, over the belly of the muſcles, it forms inoſculations with the leſſer ſaphena. From the inſide of the leg the trunk aſcends on the inſide of the knee, where it receives ſeveral branches, coming round the joint, and over the head of the tibia. Now paſſing ſomewhat obliquely, it aſcends upon the thigh, and at the ſame time, turns from the inſide to the fore-part of the thigh. In the thigh the great ſaphena receives many branches, and is not always a ſingle vein: for ſometimes the branches collecting form a ſmall trunk, running collateral to the greater vein, and which joins it in the groin. In all this courſe the ſaphena vein is ſuperficial and lies imbedded in the cutaneous fat; with but a very ſlight and imperfect aponeuroſis incloſing it; while it is external to the proper faſcia of the leg and thigh. As it aſcends upon the thigh, however, it does not dive ſuddenly under the faſcia; but is gradually enveloped and embraced by the condenſed cellular membrane and faſcia.

When it was more the practice than at preſent to bleed in the ankle, the ſaphena major was the vein ſelected: but as in all the courſe of the vein, from the great toe to the knee, it is connected with the nerve which bears its name, there are not wanting inſtances of thoſe bad effects from pricking of this nerve, which not unfrequently follow the bleeding in the arm.

SAPHENA

SAPHENA MINOR *.—This vein arifes from the plexus on the outfide of the dorfum pedis: it runs over the outer ankle and above the fafcia, covering the tendons of the peronei mufcles. Here receiving many branches and forming frequent deep inofculations, it mounts on the outfide of the vagina or fafcia, which covers the back of the leg, until arriving betwixt the hamftring tendons it finks into the popliteal hollow, terminating in the popliteal vein.

The other veins of the lower extremity which accompany the arteries in their courfe, need little defcription.

ANTERIOR TIBIAL VEIN.—The veins accompanying the anterior tibial artery form many inofculations, and when minutely injected, almoft conceal the artery. They are the anterior tibial veins, and only unite into a trunk, where perforating the interoffeous ligament it joins the popliteal vein.

POSTERIOR TIBIAL VEIN.—In the fole of the foot we have the external and internal plantar veins, which uniting into trunks, accompany the artery behind the inner ankle. In its courfe betwixt the foleus and the tibialis anticus mufcles, it cannot be called the pofterior tibial vein; for it is a mere net-work of veins furrounding the pofterior tibial artery. It receives, near its termination, a branch called SURALIS, from the gaftrocnemii and foleus: it terminates in the popliteal vein.

THE VENÆ PERONEÆ, are the venæ comites by the tibial artery, and are two or three in number. All thefe veins have free inofculations with each other.

THE POPLITEAL VEIN.—This vein is formed by the three divifions of deep veins accompanying the arteries of the leg, and the faphena minor. It lies more fuperficial than the artery, and feems to cling round it. As it afcends, however, it twifts round the artery, the artery being neareft the bone—a little above the joint it receives the leffer faphena.

* *Vena faphena parva externa.*

This

This vein, perforating the tendon of the triceps, comes to the fore-part of the thigh, ſtill united to the artery: it is now the CRURAL VEIN. As it aſcends it gets from behind the artery, ſo that in the groin it lies nearer the pubes than the artery does: oppoſite the trochanter minor it receives the internal and external circumflex veins, and the VENA PROFUNDA FEMORIS. About an inch below Poupart's ligament the crural vein receives the ſaphena major, and the ſmall external pudic veins.

EXTERNAL ILIAC VEIN.—The femoral vein lying on the inſide of the artery or nearer the pubis, enters the abdomen under the femoral ligament, and paſſing by the ſide of the Pſoas muſcle becomes the external iliac vein. It receives ſeveral leſſer veins juſt within the ligament, particularly the epigaſtric vein from the muſcles and integuments of the belly, and the veins accompanying the arteria circumflexa ilii. The external iliac vein is joined by the HYPOGASTRIC VEIN which aſcends from the pelvis. It requires no minute deſcription; it anſwers to the diſtribution of the hypogaſtric artery. This, which is the internal iliac, joining the trunk from the thigh, forms the COMMON ILIAC VEIN.

VENA CAVA ABDOMINALIS *.—A little lower than the bifurcation of the aorta, the right and left common iliac veins unite. By this union they form the vena cava. This vein aſcends upon the right of the aorta. It receives fewer branches than would naturally be imagined, becauſe the veins of the viſcera take their courſe by the porta into the liver. It receives the lumbar veins, the ſpermatic veins, the renal, ſuper-renal, and phrenic, veins. Paſſing upward it is received into its appropriate foſſa in the liver, and ſeceding a little from the ſpine it receives the VENÆ CAVÆ HEPATICÆ and perforates the diaphragm; entering the pericardium it expands into the great ſinus, or right auricle of the heart †.

RENAL VEINS ‡.—Theſe veins are leſs irregular than

* *Vena Cava inferior.*

† *Venæ Cavæ luſus. Act. Petrop. tom.* xii. p. 262. *Sandiſort Theſ.* vol. i. p. 3;8.

‡ Emulgent veins.

the arteries of the kidney, which relation of the veins and arteries is uncommon. From the relative ſituation of the kidneys to the cava, it is evident that the right vein muſt be ſhort; the left comparatively longer, and taking a courſe from the kidney over the aorta *.

SUPRA-RENAL VEINS.—Theſe little veins are like the arteries in their courſe. The right one enters ſometimes into the vena cava, ſometimes into the renal vein. The left ſometimes receives the phrenic vein of that ſide and enters into the renal vein.

SPERMATIC VEINS.—The veins of the teſticles return from the minute extremities of the ſpermatic artery, diſtributed in the body of the gland and in the epidydimis. As theſe veins reach the cord they become very tortuous, and encircling the convolution of the ſpermatic artery, form a thick vaſcular body. The higher theſe veſſels are, the nearer to the ring, the leſs convoluted they are, which makes the cord of a pyramidal ſhape. This is moſt remarkable in brutes; and in them chiefly have theſe veſſels got the name of CORPUS PAMPINIFORME †.

The ſpermatic vein before it enters the abdomen, has collected the principal branches and is fortified with valves. Theſe valves, however, ſometimes loſe their office in conſequence of dilatation of the veins, and then comes a very unpleaſant varicoſe ſwelling of the ſpermatic cord.

The ſpermatic vein courſing round the loins, gathers branches from the fat of the kidney, the ureter, &c. The right vein is generally double, the left ſingle; the one joins the cava, the other the emulgent vein.

* The Renal veins, however, ſometimes vary in their number, the right being double or triple, the left even ſometimes in four branches.

† Pampiniformis, *i.e.* reſembling the tendrils of the veins. *Icon Anatomic. Corporis humani Faſciculus* iii. *tab. Arter. Pectoris.*

PART

PART IV.

OF THE LYMPHATIC AND LACTEAL SYSTEMS OF VESSELS.

CHAP. I.

INTRODUCTORY VIEWS.

WE have underſtood that the red blood circulates in the body, through veſſels (the arteries and veins) which have a direct communication at their extremities by inoſculation; that although theſe veſſels lie parallel to each other, and extend from the heart to the remoteſt part of the body, yet the blood is ſaid to paſs through the circulation, becauſe it is tranſmitted from the veins into the arteries through the cavities of the heart; and from the extremities of the arteries directly into the veins, returning again to the centre. In this tranſmiſſion of the blood through continuous tubes, there is in the coats of the veſſels an alternation of contraction and relaxation which impels it forward. But beſides theſe arteries and veins carrying the red blood through the body, there are other pellucid veſſels more remote in their connection with what is generally called the circulating ſyſtem.

SECTION I.

OF THE CAPILLARY VESSELS.

THE capillary veſſels are thoſe extreme branches which are as minute as hairs; but this, though the li-

teral, is not the general meaning of the term. By capillary veſſels is rather underſtood thoſe branches in which the changes are wrought from the blood, and which are either ſo minute as not to allow the promiſcuous flow of the blood, or poſſeſſed of ſuch a degree of irritability and appetency, as only to allow certain parts of that fluid to be tranſmitted.

It is proved that in the living body there is no exudation; but no ſooner is the animal dead, than the fluids exude from the veſſels, the ſecretions paſs through the coats of thoſe receptacles which formerly contained them, and parts partake of the colour of that which is contiguous. From this fact, we are led to think that a property exiſts in the living fibre, which repels the fluids. Admitting this, it is very natural to ſuppoſe that the fibres, and more particularly the veſſels in the capillary texture of each organ poſſeſſes ſenſibility, which has its relations to the fluids paſſing through them, or to be ſecreted from them.

If we admit this, we may alſo foreſee the explanation of the moſt puzzling phenomenon of inflammation. Inflammation is the effect of excitement: there is increaſed action of the arteries; and by the operation of the ſame cauſe, there is a deſtruction of the natural ſenſibilities of the capillary veſſels, ſo that they no longer are poſſeſſed of their diſtinguiſhing ſenſibility, and they admit the promiſcuous paſſage of the red blood; they become dilated by the action of the arteries, and viſibly diſtended with red blood. The effect is not merely the mechanical derangement of the particles of the blood. The chemical changes which take place in the extreme veſſels are diſordered, and the blood depoſits upon the extreme branches of the nervous ſyſtem an unuſual proportion of irritability; ſo that with the redneſs ariſing from the circulation of red blood through the hitherto pellucid veſſels, in parts not endowed with ſenſibility, there is acquired an unuſual ſenſibility, and the power of tranſmitting the ſenſation to the ſenſorium. Since we ſee that in an inflammatory ſtate the pellucid veins tranſmit red blood, and that this red blood muſt be ſupplied

ſupplied by the ſerous arteries; then it is proved that anſwering to the pellucid arteries (in their natural ſtate) there are pellucid veins. We acquieſce therefore in the opinion that ſuppoſes both the arteries and veins to have pellucid capillary branches anſwering to each other, collateral to the larger and more evident anaſtomoſis of their red extremities. Theſe anaſtomoſing branches of the arteries and veins in which the red blood is ſeen to circulate, perpetuate the flow of the greater part of the blood back to the heart, while the ſeveral ſecretions are performed in the capillary veſſels; but there is no reaſon to ſuppoſe that the fluids ſent from the arteries into theſe pellucid capillary veſſels are all poured out in form of ſecretions: part returns into the extremities of the circulating veins. The ſecreted fluids and ſolids are either carried away by ducts into their receptacles, or thrown out from the body: while thoſe fluids which are exuded on the cellular membrane and cavities are re-abſorbed by the ſyſtem of abſorbing lymphatics.

We ſay then that arteries terminate, firſt, in red veins; which is proved by the microſcope, and by mercurial and other injections; ſecondly, in glands; thirdly, in cells receiving red blood; fourthly, in lymphatic veins; fifthly, in exhalents, which pour their fluids into the cellular membrane, cavities, joints, &c. and which fluid is taken up by the valvular lymphatic abſorbents.

But theſe abſorbent veſſels, of which we are now to treat under the diviſion of lymphatics, do alſo perform a circulation, in as much as they convey back to the centre of the ſyſtem the fluids, which have been thrown out from the extremities of the arteries. But as theſe lymphatic veſſels are not continued from the extremities of the arteries as the red veins are, as they imbibe the fluids, which have been thrown out of the othe ſyſtem of veſſels; their fluid contents cannot be conveyed through them by the force of the heart and arteries, theſe veſſels muſt be peculiar in having powers within themſelves, firſt of abſorbing, and then of propelling their fluid onward to the heart.

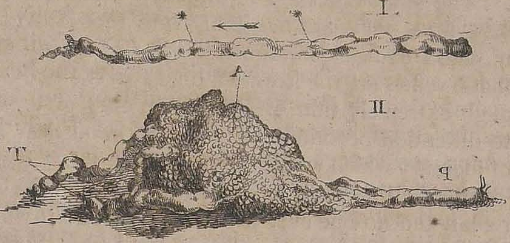
The LACTEALS are veſſels which, diſtributed to the inteſtines, abſorb and convey into the ſyſtem the milky opaque fluid which is generated in the inteſtines by the proceſs of digeſtion.

The common property of abſorption in the lymphatics, abſorbents, and lacteals, and their being connected with the ſame trunk, occaſions their being conſidered as one ſyſtem of veſſels; looking upon the general œconomy of the living body, we find them miniſtering to very different purpoſes. The one branch of the ſyſtem, the lymphatics, conveys it again into the circulating ſyſtem. The lacteal veſſels on the contrary, are thoſe veſſels which opening upon the inner ſurface of the inteſtines receive into them the nutritious fluids, prepared by the organs of digeſtion, and ſuited to ſupply the inceſſant waſte and deſtruction of the ſolid and fluid parts of our frame, which have been abſorbed and carried away by the lymphatics. Following this ſimple view, although the abſorbent ſyſtem be commonly divided into the thoracic duct, lymphatics, lacteals, and glandular apparatus attached to them, I ſhall throw the preſent ſection into the diviſions of the lymphatics and of the lacteals.

SEC.

SECTION II.

OF THE LYMPHATIC SYSTEM IN PARTICULAR.



THE lymphatic veſſels are tubes whoſe coats are perfectly pellucid, having a remarkable power of contraction, which cauſes them to ſhrink, and diſappear, ſo as to render it difficult to demonſtrate them. Indeed they are only to be obſerved by an eye accuſtomed to make lymphatic injections. They are called LYMPHATICS, or DUCTUS AQUOSI, from their tranſmitting a fluid colourleſs as water. When they are diſtended with their fluids, they ſhew that they poſſeſs a very diſtinct character from the other veſſels. They are irregularly diſtended, knotty, and ſometimes like a chain of beads, or little irregular veſicles connected together. This irregularity is owing to their numerous valves, which are ſemilunar membranes, like thoſe of the veins, hung acroſs their cavities, ſo as to catch and interrupt the reflu-

EXPLANATION of the PLATE.

I. The appearance of a lymphatic, injected with mercury, and diſſected out. *-* point to the two moſt perfect valves of this veſſel.

II. A lymphatic gland injected with mercury, and diſſected out. A. The gland apparently conſiſting of many veſicles or cells. P. The lymphatic entering the gland. T. Lymphatics emerging from the gland.

ent lymph*. They ſay, in general, that in the ſpace of an inch the lymphatic veſſel has three or four pairs of valves. But this bears no certain proportion; for as theſe veſſels run where they are expoſed to occaſional compreſſion from the ſurrounding parts, or bear the weight of a high column of fluid, their valves are more frequent. The lymphatics are improperly called cylindrical tubes, ſince they are irregular from their valves, branching, and frequent communications. The coats of the lymphatic veſſels are the ſtrongeſt of any in the body; for although extremely thin and pellucid, they give reſiſtance to diſtention beyond a certain point, and bear a column of mercury which would burſt through the valves of veins, and tear the coats of arteries. If there be a muſcular coat, and no one ever denied the muſcularity of the lymphatics, then we may reckon three coats: Firſt, The inner coat, which is the continuation of the inner tunic of the veins, as may be obſerved in the opening of the thoracic duct into the left ſubclavian and left jugular veins. It is ſmooth and poliſhed, forms duplicatures or valves, and prevents the tranſudation of their fluids: it is connected by cellular membranes to the middle coat. Secondly, The muſcular or middle coat, which conſiſts chiefly of muſcular fibres, which, according to Sheldon, run in every poſſible direction, though the greater number take the circular direction. And, laſtly, the outer coat, which is connnected with the general inveſting cellular membrane. As the inner coat muſt chiefly form the valves, and as the valves poſſeſs ſo wonderful a power of reſiſting the column of mercury, I conceive that the inner coat is that on which the ſtrength and reſiſtance to diſtention of the lymphatics depends, though it has been ſaid that it is to the outer coat that they owe this property. The muſcularity of theſe veſſels is rather inferred than proved: it is inferred from the unaſſiſted action which they have to perform in preſſing the abſorbed fluids onward to the heart. Nevertheleſs we ſometimes

* *Ruyſchi Dilucidatio Valvularum.* Vet. Oper. Vol. i.

ſee the lymphatics of the lower extremities of a colour ſo red and fleſhy, that we may ſay their muſcularity is demonſtrable.

The lymphatics ſeem to poſſeſs little elaſticity; when they are blown into, they riſe with the ſlighteſt force, and remain diſtended, although the paſſage of the air forward be uninterrupted; whereas, had they conſiderable elaſticity, they would contract and diſappear. Indeed, when empty, in the dead body they may be rather ſaid to be collapſed than contracted.—Although the lymphatics can be diſtended with the ſlighteſt inflations, yet when diſtended, as we have already obſerved, they firmly reſiſt further dilatation. This is a quality neceſſary to their valvular ſtructure, for if they were elaſtic beyond this degree of dilatation, the calibre of the veſſel would be occaſionally ſo enlarged as to render the valves incapable of meeting, and of preventing the retrograde movement of the fluids.

SECTION III.

OF THE GLANDS OF THE ABSORBENT SYSTEM.

EVERY where throughout the body and viſcera betwixt the extreme branches of the abſorbent ſyſtem and the trunk, glandular bodies are interpoſed. Though of various forms they are generally of an oval ſhape, and they vary in ſize from the twentieth part of an inch to a full inch in diameter. Sometimes they are ſegregated,—ſometimes accumulated and cluſtered together. The colour of thoſe bodies is various in the ſeveral parts of the body: in young animals they are redder, and become pale only with age. They are redder and ſtronger in the outer parts of the body, as in the thigh, axilla, &c. leſs ſo within the abdomen and thorax. 2. The latter will not bear ſo high a column of mercury as the former.

The mesenteric glands are said totally to disappear in old age*.

It would appear that the glands of this system are of more importance to young animals than to adults. In the fœtus and in children the lacteal and lymphatic glands are exceedingly numerous; but they shrink or disappear with old age. In the fœtus, they can be of no very essential use; they are then rather in a state of preparation for the actions necessary in infancy and youth. It is then also that they are most liable to disease, and seem more irritable and ready to inflame, especially in superficial situations. About the age of fourteen or fifteen this disposition is changed, which is commonly said to proceed from the increased vigour of the constitution, and the change which then takes place on the organs of generation. It is rather to be attributed, however, to the diminution of irritability and activity of the vessels of the glands at this age, for as we have said, the glands are now smaller and paler. We may further observe that the lymphatic glands, even in the scrophulous diseases, are seldom primarily affected: that they partake of diseased action from the surface, or from an affection of the intestines, or from the absorption of matter. The structure of these glands has not been satisfactorily investigated; or the inquiry is attended with insurmountable difficulties. Some anatomists have said, that they consisted of the convoluted absorbent vessels; others that they are of a cellular structure. When they affirm that these cells are totally distinct from the lymphatic vessels, it is not so easy to understand them; for cells communicating with each other, and into which the lymphatic vessels enter, are very much the same with a series of convoluted, varicose, and irregularly dilated vessels. If we could dissect this series of cells, as Haller did the vesiculæ seminales, we should have represented to us the appearance of a convoluted varicose vessel.

There is a coat of cellular membrane which surrounds

* By Ruysch, Morgagni, Haller, Sheldon.

the

the glands. This coat is pervaded by a peculiar fluid which has given riſe to ſome ſpeculation. It is obſerved chiefly in young animals, and is for the moſt part, though not always, white and milky, and in the glands of the lungs it is of a blackiſh colour. This is the fluid which having globules in it, was ſuppoſed by Mr. Hewſon to be the firſt ſtage of the formation of the red globules of the blood. It is diſtinct from the abſorbed fluids, and is a ſecretion from the arteries. Phyſiologiſts have not determined the nature or uſe of this fluid.

At preſent there ſeems no better hypotheſis to be offered regarding the uſe of the lymphatic and lacteal glands, than that they ſerve to check, controul, and meaſure the flow of the abſorbed fluids into the maſs of the blood: without them it appears to me probable that at one time the lymph returning from the body, or at another time the chyle, might flow too rapidly, and in a diſproportioned quantity into the veins and heart. But by the check which the glands impoſe upon this flow, giving a remora, and ſerving as receptacles of the abſorbed fluids, the fluids are poured with a more uniform and conſtant flow upon the heart.

SECTION IV.

ORIGIN OF THE LYMPHATICS, AND OF THE DOCTRINES OF ABSORPTION.

THE lymphatics, forming a ſyſtem of abſorbents, we might ſay, in general, that they take up all the fluids which have been thrown out upon the ſurfaces of the body. Thus they ariſe from the pores of the ſkin; from the ſurface of the cavities and viſcera covered by the pleura and peritoneum; from the cells of the interſtitial and adipoſe membrane, &c. This is the ſimple uſe aſſigned to this ſyſtem of veſſels: but whether they are the only ſyſtem of abſorbents; whether they carry away

away all the parts of the fyftem, fluids, and folids; whether they abforb the mufcles, membranes, bones, tendons, &c. of which the folid body confifts, is a queftion requiring fevere examination. It cannot be denied that although the fyftem and doctrines of abforption be the moft beautiful and interefting, and apparently the fimpleft in the whole œconomy, yet it is founded on very few facts, while there is much doctrine tacitly acknowledged, which feems in fymmetry with the facts and the laws of the œconomy, but which is not founded in abfolute proof. We fhall firft examine the proofs of the lymphatics being the veffels which abforb the fluids of the cavities and furfaces of the body. The animal machine univerfally partakes of motion. A principal provifion for this mobility of parts, is the loofenefs of the cellular membrane which every where pervades the body, and fupports the veffels and connects the feveral parts. This interftitial membrane is elaftic, and being cellular, to allow of motion, its furface is bedewed with ferous exfudation. This fluid is perpetually paffing from the extremities or fides of the lymphatic arteries or capillaries, into the cellular membrane, and upon all the cavities of the body. The fluid extravafated is called ferum, and fome have fuppofed that it paffes through inorganized pores, an expreffion that is not very intelligible; but if by this is meant (as has fometimes been explained) "accidental pores" in the fides of the veffels, it is a fuppofition quite improbable and unlikely *. The pores or veffels from which this fluid exudes are called exhalent; and their action is no doubt as completely fecretion as that which produces the fluids, which in our wifdom we call more perfect fecretions.

That the lymphatics take up the fluids thrown out in

* Dr. Hunter fupported this opinion (Commentaries p. 40,) viz. "that the fluids of cavities were collected by tranfudation, and not thrown out by exhalents;" an opinion which could only have arifen from not correcting the ideas received in making injections in the dead body by the phenomena of the living fyftem. See *Hewfon on the Lymphatic Syftem*, chap. viii. where the opinion of inorganical filtering is fuccefsfully combated.—See also Cruickfhanks.

the

the cavities of the body, as the abdomen, thorax, pericardium, &c. there is what nearly amounts to an abſolute proof, in comparing the fluids of thoſe cavities with that contained in the veſſels; for by the experiments of Hewſon it is found that if the fluid moiſtening the cavities be collected, it will form a jelly when expoſed to the air, as the coagulable lymphatic does. Again, if a lymphatic veſſel be tied up in a living animal, and then opened ſo as to allow the fluid to flow into a cup, it will alſo form a jelly like the coagulable lymph*. The fluid of cavities alters in animals diſeaſed; ſometimes retaining its coagulability, and even acquiring ſtronger powers; ſometimes loſing it altogether. But what is moſt eſſential to our preſent purpoſe, it has been obſerved, that whatever change takes place in the fluids of the cavities, the ſame is found to have taken place in the lymphatics.

But the ſtudent naturally aſks, how is the lymph taken into the lymphatic veſſels; and here it muſt be confeſſed, there is too much field for conjecture.

It was thought formerly that the lymphatic arteries terminated in ſmall pellucid veins: theſe veins carrying only the thinner, and refuſing the red part of the blood, were called lymphatics. When the anatomiſt threw in his minute injection, and ſaw the coloured fluid return by the red veins, and the colourleſs fluid return by the lymphatics †, it was held as a ſufficient proof of the accuracy of the preconceived notion, and tallied with obſervations of Leewenhoeck, and the theory of Boerhaave. See in-

* But, by diſeaſe, the fluids in the cavities and cellular membrane is altered. In dropſy, for example, the fluid of the abdomen loſes the property of coagulating on mere expoſure; it comes to reſemble more the ſerum of the blood: this were ſufficient proof that the collection is not owing merely to the diminiſhed abſorption, but that there is a change of action in the veſſels of the peritoneum, pleura, pericardium, &c. An inflammatory action of the veſſels will throw out a fluid more coagulable, and which, in a high degree of action, will form a film of coagulable lymph or even pus on the ſurface. But in a ſtate the reverſe of inflammation, ſuch for example, as the debility following inflammation, a ſerous effuſion will be poured out, having little tendency to coagulate.

† It was probably Nuck who firſt injected the lymphatics from the arteries.

troduction

troduction to the account of the viscera. When, however, anatomists more carefully examined the state of parts, they found that the lymphatics were not filled, unless the cellular membrane was previously injected by the extravasation of the fluid from the blood vessels. Finding that this alledged experiment was really no proof of the anastomosis, and direct communication betwixt the extreme arteries and lymphatics, they conceived that it was a proof that these lymphatics took their rise from the cellular interstitial texture. Then injecting with mercury, they found that when the vessels burst, and the column suddenly descended, and the cellular membrane was filled, the mercury was seen to rise in the lymphatics. Following up this, they blew air, or injected various fluids directly into the cellular membrane, and injected the lymphatics. Thus by an error, by an accidental effect of their injection, the minds of Dr. Hunter and Monro were opened to a freer discussion of the received opinions and approved authorities. Soon, however, it was understood by those conversant with anatomy, that these accidental injections of the lymphatics did not prove the lymphatics to take their origin either from the cells or from the extreme arteries; but already this good effect, at least, was produced, that men's minds were excited to enquire after new facts, and to follow a new train of observation. It was now recollected, that a strict analogy and correspondence subsisted betwixt the lymphatics and lacteals; the proofs of the lacteals being absorbents, were recalled to memory; new proofs of their being the sole absorbents of the intestines were brought forward; the nature of the fluids effused into the various cavities and cells of the body was attended to; and the conviction followed, that the most essential use of the lymphatic vessels was to serve as a system of absorbents, to take up the extravasated fluids. They reflected that to distend the intestines with injection would never fill the lacteals; and were convinced that the injection of the lymphatics could not be supposed to be through the proper absorbing mouths of these vessels opening upon the cells; but rather that the injection had entered the vessels by the rupture of their extreme branches.

branches. Thus the theory of the lymphatics being a ſyſtem of abſorbents, came to reſt on analogy, and the obſervation of the phenomena of the living body.

The chief proof of the lymphatic abſorption has been derived from the manner in which the venereal virus is received into the ſyſtem. Venereal matter being allowed to lodge upon the delicate ſkin of the glans penis or preputium, cauſes an ulcer there. The matter of this ulcer is abſorbed by the lymphatic of the part; an inflamed line is ſometimes to be traced into the groin; and the lymphatic gland of the groin receiving this abſorbed matter, inflames and forms the bubo. Here, then, is a proof that the red veins do not abſorb, and that lymphatics do: elſe why are they inflamed?—and why are the lymphatic glands inflamed to ſuppuration?

We muſt obſerve, however, that there is here by no means an abſolute proof of abſorption of venereal matter. Although, therefore, we believe in the general ſyſtem, we may hazard theſe queries:—If this matter is abſorbed, why is there no infection without ulcer (chancre) of the glans? If this ulcer be produced by abſorption, how comes it that the conſtitution is not infected by the firſt abſorption of the matter, and before it has formed an ulcer? Is it not probable that the irritation of the venereal matter, lodging on this vaſcular ſurface, and without being abſorbed, cauſes a peculiar inflammation, the tendency of which is to form a puſtule, and to produce matter ſimilar to that which originally infected the part with the ſpecific and peculiar action? Again it will be ſaid, however the venereal puſtule was originally produced, it appears evident that the abſorption of this matter, the conveying of it along the lymphatic, inflames the veſſel, and the next lymphatic gland into which it enters, receiving the venereal matter, inflames and ſuppurates, &c. But again, I chooſe to ſay, with every ſhow of likelihood, that neither is this a proof of abſorption; but that the lymphatic veſſel being very irritable, and always receiving its ſtimulus to action

from

from its extremities, it has partaken of the venereal inflammation; that this inflammation has been propagated to the gland; that, the gland being formed of the convoluted lymphatic veſſels, the effect of this inflammatory action is there accumulated to ſo great a degree as to deſtroy the function of the gland and lead to ſuppuration *. And further, that the diſeaſe is received into the conſtitution only in conſequence of the ſyſtem at large partaking of the irritation (a word which but imperfectly expreſſes the change) of the local action of veſſels. Matter might be abſorbed and taken into the conſtitution, and the diſeaſe propagated according to the common explanation; but, according to that offered here, there muſt be a primary and local diſeaſe, from which the general affection is propagated. If we are to take the inflammation and hardening of the lymphatics and axillary glans as a ſymptom of abſorption from a diſeaſed mamma, we muſt acknowledge the ſame proof in evidence of the veins abſorbing: for although the lymphatics are more active, and their activity depending on the ſtate of their origins and extreme branches, and although they be more liable to inflammation than the veins; yet are the veins affected in a way that would, on this proof, as unequivocally prove them to be abſorbents; for we ſee how they enlarge around a diſeaſed breaſt, become prominent and hard, and loſe their ſoftneſs and elaſticity; how they ſhew themſelves on the ſurface of a white ſwelling, or on a cancerous tumour. But, as we would not ſay that this is a proof of abſorption by the veins, neither is the proof unequivocal that there is abſorption by the lymphatics. Again, a ſuppurating ſtump, with bad inflammation, will cauſe inflammation of the lymphatics, and ſuppuration in the glans of the groin †; a

* If a chancre be indolent, although matter be formed in it, no bubo will be produced: but if the ſurgeon applies ſome corroſive dreſſing, which, inſtead of entirely deſtroying the diſeaſed ſpot, inflames it; then will the gland in the groin ſympathize and riſe into a bubo.

† See Hunter's Commentaries.

proof

proof of abſorption of the matter of the ſtump: but do we not find that from ſuch a ſtump the veins aſcend, inflamed and ſuppurating, while ſometimes a chain of abſceſſes is formed for a conſiderable extent? This, we can have no doubt, is the effect of the inflammation continued along the veſſel; and is not the inflammation produced preciſely in the ſame way in the lymphatic?

I found my opinion of the lymphatics being abſorbents,—firſt, on the circumſtance that their ſtructure is adapted to this action; ſecondly, on the analogy between them and the lacteals, in which abſorption is proved; thirdly and laſtly, upon their continuing to receive and tranſmit their fluids, after the heart and arteries have ceaſed to beat, and the red blood to circulate: for then how can they act, but by their own powers? How can they receive fluids, but by abſorption? Finally, this phenomenon ſhews in the lymphatics, a greater degree of irritability, and ſtronger principle of activity and tenacity of life, than actuates any other ſet of veſſels.

OF THE ABSORPTION OF SOLIDS.

On examining the works which within the laſt forty years have contributed to throw light on this ſubject, we at once acknowledge how neceſſary it is for that part of a ſyſtematic book of anatomy, which profeſſes to treat of abſorption, to take the form of a critical inquiry. When the abſorption of the fluids of the cellular ſubſtance, or in the cavities, was univerſally aſſented to, phyſiologiſts did not make ſufficient diſtinction betwixt the abſorption of the fluid thrown out of the influence of the circulating veſſels, and that matter which continued to be involved in the membranes and veſſels, and which formed the ſolid part of our frame. It will readily be allowed that the fluid thrown out upon the ſurfaces of the body and in the cells, might be abſorbed without inferring that every part of the body, ſolids and fluids, were alſo taken up by the lymphatic abſorbent veſſels. But phyſiologiſts obſerving that the ſolid parts

of the body were ſuffering perpetual change; that the whole body and the veſſels themſelves were formed, decompoſed, and carried away; they heſitated not to attribute this to the depoſition from the arteries, and the abſorption by the lymphatics. This alternate deſtruction and renovation of parts, the perpetual change which the whole body ſuffers, has been univerſally acknowledged and attributed in part to the operation of the lymphatic ſyſtem, without any other proof than a ſlight analogy.

The interſtitial fluids, and the fluid in the cavities, is imbibed by the abſorbing mouths of the lymphatics on the ſurface of the membranes; but where is the analogy between this and the deſtruction of ſolid parts? It has been ſaid that the abſorbents eat down the ſolids, and nibble like the mouth of a worm! a conjecture, the falſity of which is equal to its apparent abſurdity. The ſolids are raiſed by the agency of the veſſels on the chemical affinities of the circulating fluids. They muſt be reſolved by their decompoſition, reducing them again to the ſtate of fluids; or the ſecreting veſſels throw out fluids which diſſolve them: an operation anterior to their abſorption. From the comparative ſimplicity of the fluids of the circulating veſſels, and that in the abſorbents, we are authorized to conclude, that as from the blood the ſeveral ſecretions, ſolids, and fluids are formed; theſe fluids, before they are again taken into the active ſyſtem of veſſels, are reſolved into their original ſimple and conſtituent parts. Thus we are not to look for the matter of the component parts of the body in the abſorbing ſyſtem of veſſels more than in the blood, from which theſe parts were originally formed; nor are we at liberty to ſuppoſe that they are taken down by a proceſs like eating or abraſion.

I conceive, that the abſorption of the ſolids depends but in a limited degree on the agency of the lymphatics; and that there is a neceſſary change in the aggregation of the matter previous to the abſorption by the mouths of the lymphatic veſſels.

EXAMINATION OF SOME OPINIONS OF MR. HUNTER ON THE SUBJECT OF ABSORPTION OF SOLIDS.

MR. HUNTER ſays that his conception of the matter is, that nature leaves little to chance; and that the whole operation of abſorption is performed by an action in the mouths of the abſorbents. Phyſiologiſts have laboured, he obſerves, to explain abſorption on the principle of capillary attraction, becauſe it was familiar; but as they were ſtill under the neceſſity of ſuppoſing action in the veſſels after the matter was abſorbed, they might as well have carried this action to the mouths of theſe veſſels.

One never could have ventured to ſuppoſe the extravagant concluſion to which this idea, once entertained, has led Mr. Hunter.—He proceeds to conſider the many kinds of ſolids the lymphatics have to carry away, and the variety of mouths in different animals, ſuited to the great variety of ſubſtances they have to work upon, and then draws the concluſion, or leaves his reader to do ſo; that not only are the mouths of the lymphatics calculated to abſorb fluids; not only do they carry away the ſolids, but each veſſel, according to the hardneſs and toughneſs of the material upon which it has to operate, has a mouth adapted for the work. Here we do not ſee the genius of Hunter, but a poverty of imagination.

Mr. Hunter takes the merit of a new doctrine relating to abſorption. He admits that oil, fat, and earth of bones had always been conſidered as ſubject to abſorption; and that ſome other parts of the body liable to waſte had been ſuppoſed to ſuffer by abſorption; but that any ſolid part ſhould be abſorbed, he ſuppoſes to be entirely a new doctrine. Now, I think we may venture to affirm, that not only was it known that ſolid parts of the body were taken away during life; but that phyſiologiſts knew each and every part of the living body to be undergoing a perpetual decay and renovation. Nay, we may venture further to ſay, that

 Mr.

Mr. Hunter did not comprehend, in its full extent, the relation in which the ſecreting and abſorbing veſſels ſtand to each other. He is fond of calling the abſorbents, modellers,—" modellers of the original conſtruction of the body,"—" modellers of the form of the body while growing."

Mr. Hunter could contemplate no change in the body during growth, decay, or diſeaſe, where there was an alteration of form or quantity of matter, without attributing it to the " modelling abſorption."—A bone cannot be removed without abſorption; nor a part which is uſeleſs to the œconomy (as the alveoli of the teeth, the ductus arteriosſus, the membrana pupillaris, the thymus gland) diminiſhed in ſize or totally carried away, without the abſorbents being in action. This is undoubtedly true; but in regard to the manner in which it is performed we cannot agree with Mr. Hunter. When it becomes neceſſary that ſome part be removed, it is evident that nature, in order to effect this, muſt not only confer a new activity on the abſorbents, but muſt throw the part to be abſorbed into ſuch a ſtate as to yield to this operation. This is the only animal power capable of producing ſuch effects; and like all other operations of the machine, it ariſes from *ſtimulus* or irritation, &c. On the contrary, I conceive that the abſorption of parts in the natural action of health or in diſeaſe, is not owing to increaſed ſtimulus, but often to a diminution of it.

Does it not ſtrike us forcibly that when a gland ſwells, and leeches and bliſters are applied, and it ſubſides, this can be no means of exciting abſorption; that when preſſure is made on a part, and that part is abſorbed, this is a ſtrange way of ſtimulating? Or, when we bleed, is it not odd that this ſhould give new power to the lymphatic ſyſtem? For theſe are the means of giving a counter irritation, and of ſuppreſſing action.

Mr. Hunter has given to the lymphatics not only the grovelling qualities of animals, as eating; but the higher attributes of intellect. They do nothing without fore-

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thought and intention; when they abſorb, it is becauſe they have found the parts uſeleſs in the œconomy. He has carried this notion ſo far, that he does not only ſpeak of the abſorption of the thymus gland, membrana pupillaris, alveoli of the teeth, &c.; but of the body in fever as a conſequence of its becoming uſeleſs when under diſeaſe!—The following may perhaps appear to be the more natural ſuppoſition.

In a living body we may obſerve the agency of the nervous, vaſcular, and abſorbing ſyſtems: and the phenomena of life are not to be attributed to any one, but to the whole of theſe. We muſt alſo obſerve, that life, or the mutual action of parts producing the phenomena of life, is proceeding from excitement, and as in the whole ſyſtem, ſo in the individual parts of the body, the healthy action depends on the influence of this excitement to action. The tendency of the growth of the body to peculiar forms, and the increaſe of parts in diſeaſe are produced by it. It acts upon the vaſcular ſyſtem in diſeaſe, by producing increaſed action and ſecretion; as a muſcle, in the uſe of frequent and ſtrong action, will become more fleſhy and vaſcular; as a gland, will be excited to greater action and more profuſe diſcharge, whilſt it enlarges and ſwells up. When a part enlarges in conſequence of the ſtimulus to increaſed action, either ariſing from the natural law of the conſtitution or from diſeaſe, it proceeds from the ſecreting veſſels preponderating over the abſorbing veſſels. There is a depoſition of matter which the latter are unable to take away. But diminiſh this action of the arteries, or take away their excitement, or cauſe an excitement of ſome neighbouring part, and thereby ſubdue their action, relieve them of their fulneſs, and the abſorbents regain their proportioned actions, and the ſwelling ſubſides. The parts of the body, which in the natural changes from youth to age, are abſorbed and carried away, are thoſe in which there is no longer the ſtimulus to vigorous action, and of courſe the lymphatics overcome the power of the ſecreting veſſels, and the

the part gradually diminiſhes, loſes its apparent vaſcularity, loſes its redneſs, and is at laſt totally abſorbed. And as the tooth of a child lies long hid under the jaw, where it partakes of the ſtimulus to the action of its veſſels, grows, and riſes up, and the alveoli, partaking of this natural excitement, alſo form around it; ſo when the tooth decays and falls out, the alveoli will alſo decay and be abſorbed; becauſe the moment theſe veſſels have ceaſed to partake of the increaſed action, their abſorbents, though acting with no greater powers than formerly, do yet ſo preponderate, that a gradual waſting is the conſequence. Thus we have to conſider, not the action of the abſorbents merely, but the relation which their action has to that of the arteries.

I ſhould conclude that a part which has ceaſed to be of uſe in the œconomy and is abſorbed, has not been carried away by the ſtimulus applied to the modelling lymphatics; but in conſequence of a want of the uſual excitement of the parts to action, and of the conſequent preponderance of the action of the lymphatics; not by an increaſe of their action, but by a greater uniformity of action, leſs dependent on the ſtate of excitement of the part. This more uniform ſtate of action, or leſſer degree of dependence on excitement, will not be denied when we ſee them continuing their action after the death of the animal, and after the other phenomena of life have ceaſed. As to the abſorption of the body in general from diſeaſe, as in fever, it appears to be ſimply the effect of the continued abſorption, while neither the organs for digeſting and aſſimulating new matter, nor the vaſcular ſyſtem for conveying the fluids, are in a ſtate to miniſter to the wants of the ſyſtem, but ſuffer under an unuſual irritation, which diſorders their function.

We ſpeak very commonly of ſtimulating the lymphatics to abſorb by mercury; for example—There may be a ſpeck on the cornea, corroſive ſublimate is given to excite abſorption. The practice is good, but ſurely this is the language of an erroneous theory. An

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inflammation from general diſorder of the ſyſtem or of the viſcera has taken place, where it is moſt of all likely to take place, a courſe of mercury corrects this diſpoſition; the cauſe removed, the inflammation ſubſides, and with that the ſpeck. The ſame argument ſuits the phenomenon when a tumour or enlargement of a viſcus is diminiſhed, better than to ſay that the mercury excites the lymphatics to the abſorption of the tumour.

As to preſſure cauſing abſorption and producing the waſting of parts, I cannot agree with Mr. Hunter in ſuppoſing that the lymphatics are here excited to action; but ſhould rather infer that the nerves of the parts being benumbed, and the action of the arteries ſuppreſſed, the lymphatics continue to do their office, while the arteries are prevented from depoſiting new matter.—For example, when we ſee a curvature of the ſpine, from a habitual inclination of the body to one ſide, and conſequently greater preſſure on the one ſide of the bodies of the vertebræ: it is natural, at firſt ſight, to ſay, ſince the one ſide of the vertebræ is of its natural depth, and the other diminiſhed, that the ſide which is deep has remained, but the other ſide has been abſorbed; but, when we inquire further into the phenomenon, which has taken place, we recollect that the matter of bone is undergoing a perpetual change, and that the matter of both ſides of the vertebra is changed; we ſee that the preſſure may not have excited the veſſels to greater action ſo as to cauſe abſorption; but that the preſſure has prevented the depoſition of new matter, when the old was taken away in the natural routine of the ſyſtem.

Mr. Hunter has aſſigned five cauſes of abſorption, which I conceive may be very naturally reſolved into one.—Theſe are, 1, parts being preſſed; 2, parts being irritated; 3, parts being weakened; 4, parts being rendered uſeleſs; 5, parts becoming dead: of the firſt we have already ſpoken; the ſecond I ſhould deny, unleſs when it reſolves into the third; for irritation does not cauſe abſorption, unleſs when it is to an extent ſufficient to deſtroy the natural action and weaken the part. The third

third and fourth come under the effect of the loss of the natural and accustomed stimulus to action in the arterial system, which of course gives a preponderance to the absorbents: of the fifth we can have nothing to add illustrative of the living system.

CHAP. II.

OF THE COURSE OF THE LYMPHATICS.

THE lymphatics, in their course and relation to the fascia and muscles of the extremities, bear a great analogy to the veins; for there are two sets or grand divisions,—the DEEP LYMPHATICS which accompany the arteries in their branchings amongst the muscles; and the SUPERFICIAL set which accompany the external veins.

SECTION I.

OF THE FOOT, LEG, AND THIGH. Even in the toes the same distinction of the origins of the lymphatics may be observed, as in the limb. For while a plexus covers the toes superficially, and runs up upon the foot with the veins, deeper branches accompany the arteries on the side of the toes. When we observe the course and origins of the greater and lesser saphena vein, we cannot fail to understand the course of the several sets or divisions of the lymphatics of the foot and legs.

From the toes, dorsum, and edges of the foot, the lymphatics climb up the leg in four classes. 1. One takes a course from the root of the great toe and inside of the foot, over the tendons of the great toe and tibialis anticus tendon. It then passes on the inside of the tendon of

of the tibialis anticus muſcle, and before the head of the tibia, following the principal branch of the great ſaphena vein; and then continues its courſe in company with the ſaphena to the inſide of the knee. 2. There is at the ſame time a conſiderable number of lymphatics, taking their origin from nearly the ſame place, viz. the inſide of the foot, and before the inner ancle; but they take a different courſe on the leg from the laſt claſs; for they paſs behind the lower head of the tibia: they now attach themſelves to ſome branch of the ſaphena vein, and join the former ſet on the inſide of the knee. From this they aſcend ſuperficially above the faſcia to the glands of the groin. 3. From the outſide of the foot there aſcend ſeveral lymphatics; a diviſion of which paſſes before the outer ancle and acroſs the tibia to join the lymphatics, paraſites of the great ſaphena vein, and here they ſometimes form plexus and contortions; others turn in behind the outer ancle, and join the branches accompanying the leſſer ſaphena.

The lymphatics which turn round behind the outer ancle paſs on the outſide of the tendo Achillis; and accompanying the leſſer ſaphena vein, ſink into the popliteal hollow. Here they unite with the lymphatics which have accompanied the ſeveral arteries of the leg and foot, and particularly the poſterior tibial artery.

Popliteal glands. The glands of the ham-ſtring cavity are generally three in number, and very ſmall. They receive the lymphatics, which paſs with the poſterior tibial artery and with the leſſer ſaphena, and they of courſe ſwell and become inflamed in conſequence of ſores on the calf of the leg, outſide of the foot, and ſole of the foot.

From the popliteal glands there aſcend two large lymphatics, which accompany the popliteal artery and venæ comites, and aſcend with the latter through the adductor magnus to the fore-part of the thigh. They run irregularly, or form a kind of net-work round the great veſſels. On the fore-part of the thigh, and ſtill deep, they (or at leaſt ſome of the principal trunks) enter the lower and deep

deep inguinal glands, or emerging, they paſs into the outward glands of the groin.

Sometimes theſe deep lymphatics, inſtead of being accumulated into larger trunks, divide into many branches, and only unite in the glands of the groin.

INGUINAL GLANDS. The inguinal glands are in number from five to ten; they lie involved in cellular membrane on the outſide of the femoral ligament. Some of them are ſuperficial and moveable under the integuments; ſome involved in the laminæ of the faſcia, deſcending from the abdominal muſcles; ſome are cloſe on the femoral artery and vein, and under the faſcia. Nearer to the pubes may be obſerved a diviſion of theſe glands which belong to the lymphatics of the penis, perineum, &c.

The greater cluſter of glands on the top of the thigh becomes affected from diſeaſe of the integuments on the fore-part and inſide of the thigh and leg; and of that part of the foot where the great ſaphena vein commences; nay, further, the inguinal glands ſwell from ſores of the buttocks, about the anus and private parts. They will even ſwell from diſeaſe of the teſticle; but this only by ſympathy.

LYMPHATICS OF THE PARTS OF GENERATION IN BOTH SEXES. From the penis there run backwards two ſets of lymphatics: ſuperficial ones, which take a courſe to the groin; and deeper ones, which take a courſe along the arteries of the penis into the pelvis, or under the arch of the pubis. The ſuperficial lymphatics are the cutaneous veſſels, and take their origin from the prepuce, and it is theſe which, either abſorbing the venereal matter of chancre, or ſympathizing with the venereal action, form ſometimes an inflamed line along the penis, and cauſe the bubo in the groin. But as there are two ſets of lymphatics, the chancre may be in a place where the deep-ſeated veſſels are the abſorbents, and conſequently the conſtitution is contaminated without any bubo in the groin; and indeed it has been obſerved, that a venereal ulcer of the prepuce will, in general,

general, produce bubo, when an ulcer of the glans will not *. When the tract of the matter is through the deep lymphatics which enter the pelvis from below, the gland through which the veſſels paſs, is not inflamed to form a bubo; neither do the lymphatic glands within the ligament of the thigh inflame to the extent of forming a bubo, either from chancre or from bubo in the groin. This, ſays a celebrated anatomiſt, Mr. Cruickſhanks, is very fortunate; for if the external iliac glands, like the inguinal glands, ſhould ſuppurate, they could not be opened by the lancet, they muſt be left to themſelves; they might burſt; the pus might fall into the cavity of the abdomen; might produce peritoneal inflammation; and might probably deſtroy the patient. Now, there appears no reaſon to dread any ſuch cataſtrophe. The matter of theſe glands would form an abſceſs, which, like other abſceſſes in the track of theſe veſſels, would fall down upon the thigh. The fact, however, is curious; that when the lymphatics diſeaſed enter one ſet of glands, there will be no bubo; when they take a courſe to the other, they inflame and ſuppurate. This I believe may be explained, from conſidering the poſition of the inguinal glands, as being immediately under the ſkin: for experience ſhews that a part near the ſurface will inflame and proceed to ſuppuration much more readily than a part deep-ſeated, though ſuffering from the ſame degree of excitement.

In the external parts of woman (by Mr. Cruickſhanks's obſervation) there are alſo two ſets of lymphatics. Thoſe near the clitoris paſs up in a direction to the ring; and thoſe from the lower part of the vulva and perineum to the glands of the groin.

LYMPHATICS AND GLANDS WITHIN THE LIGAMENT OF THE THIGH. The vaſa efferentia of the inguinal glands are in number from two to ſix. The deep lymphatics which accompany the femoral vein and artery, lying under the cellular membrane, paſs under the ligament, and ſoon form a large net-work of veſſels accom-

* Cruickſhanks, page 138.

panying

panying the iliac veſſels, in which they are joined by the branches of lymphatics from the ſuperficial glands; ſometimes the trunks accompanying the great veſſels of the thigh paſs into a gland, immediately within the ligament; ſometimes one or two of them only enter into the glands high in the loins; nay, ſometimes a large veſſel paſſes on directly to the thoracic duct.

From ſix to eight or ten glands are ſeated in the tract of the external iliac veſſels, under the name of EXTERNAL ILIAC GLANDS. And upon the inſide of the brim of the pelvis, and on the hypogaſtric veſſels, the glands are called the INTERNAL ILIAC GLANDS. In proportion to the frequency of diſeaſe in the pelvis, theſe external iliac glands, being in the tract of the lymphatics of the private parts and rectum, &c. are particularly ſubject to diſeaſe. Thoſe glands alſo which are called SACRAL GLANDS, as lying on the meſo-rectum, and in the hollow of the ſacrum, have been obſerved to be often diſeaſed. On the pſoas muſcle, and on the loins it is impoſſible to trace the veſſels as ſingle trunks; we may obſerve that one net-work of veſſels aſcends upon each pſoas muſcle from the thigh; that there it is joined by the lymphatics of the pelvis. Theſe veſſels are in a manner united by thoſe which cover the prominency of the ſacrum, and paſs under the bifurcation of the aorta. The two GREAT LUMBAR plexus of lymphatics continuing their aſcent, many of the veſſels enter into the lumbar glands; and on the loins they are joined by the abſorbents of the teſticle. By the union of the lymphatics aſcending from the right and left ſide, with ſeveral large trunks of the lacteals from the root of the meſentery, the thoracic duct is formed on the third and fourth vertebra of the loins.

OF THE LYMPHATICS OF THE ARM.

IN the arm, as in the leg and thigh, there are two ſets of lymphatics:—the ſuperficial and deep-ſeated. The firſt of theſe accompany the cutaneous veins, the latter the deep arteries.

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As in general there are two great veins on the fore-arm, the basilic and cephalic veins; but particularly as the veins which gather into the basilic trunk, on the inner and lower edge of the fore-arm, are the larger and more numerous class; so it is found that the course of the more numerous class of lymphatics is on the lower and inner side of the fore-arm, and that they accumulate about the basilic vein. These are derived from the palm of the hand, and from the ulnar edge of the hand. This set sometimes passes into glands, seated on the brachial artery, near the inner condyle of the humerus.

The absorbents which accompany the cephalic vein, arise from the side of the thumb and fore-finger upon the back of the hand; they run on the radial edge of the arm, with the veins which ascend to form the cephalic vein. From the bend of the arm these vessels take a course on the outer edge of the biceps, and then get betwixt the inner edge of the deltoid, and outer edge of the pectoral muscles; they then pass under the clavicle, and descend into the axillary glands. This set of absorbents receives the branches from the outside of the arm in their whole course.

There are absorbents arising from the back of the hand, next the little finger, which following some of the branches of the basilic vein (a larger branch of which is called the ulnaris externa) turn round the ulnar edge of the arm, are inserted into a gland, very commonly found before and a little above the inner condyle of the humerus. From this gland a large lymphatic passes upwards, and attaching itself to the brachial artery, splits and plays around it.

The deep seated lymphatics of the arm accompany the arteries in the same manner as the venæ comites do; in general two with each artery. They all terminate in the glands of the axilla, and can require no particular description. The lymphatics, from the muscles and integuments on the back of the shoulder, also turn round and enter into the glands of the axilla.

The GLANDS OF THE ARM are small, and irregularly placed

placed in the courſe of the humeral artery, from the condyle to the axilla. They are from three to ſix in number.

The GLANDS OF THE AXILLA are large and numerous; they receive the lymphatics from the arm, breaſt, and ſhoulder *; they lie in the deep cavity of the axilla, formed by the tendons of the pectoralis major, and latiſſimus dorſi muſcles. They are imbedded in a looſe cellular membrane, which, while it ſurrounds and ſupports the veſſels of the axilla in the motions of the joint, gives them ſtrength from its elaſticity. Theſe glands do not all ſurround the axillary artery; but a lower cluſter is attached to the branches of the ſubſcapular artery, going forward on the ſide of the cheſt, and to the thoracic arteries. Theſe it is which, indurating from cancer of the breaſt, require ſo frequently to be extirpated. Theſe glands of the axilla greatly inlarging cloſe upon the artery and plexus of nerves, ſo as to preclude the poſſibility of an operation; they compreſs the veins and benumb the arm by preſſure upon the nerves. When they ſuppurate, they cauſe a condenſation of the cellular membrane which ſurrounds them, and in conſequence, a compreſſion of the axillary nerves and a ſhrinking of the arm.

When a wound or puncture, ſuch as that which the ſtudent of anatomy may receive in the diſſecting room, has been made on the little or ring finger, the red lines which often appear in conſequence of it, have taken the courſe of the ulnar edge of the fore-arm, and terminate in the inſide of the arm, near the condyle; in ſome inſtances they have been continued even into the axilla. If venereal matter is abſorbed at any part of the hand, near the little or ring finger, or by thoſe fingers, the gland on the inner condyle of the humerus, or ſome one in the courſe of the brachial artery, will moſt probably inflame and form a bubo, and the ſurgeon will be aware of this

* "They even receive abſorbents from the cavity of the cheſt, and I have known them ſwell from pleuriſy, peripneumony, and pulmonary conſumption." Cruickſhanks.

abſorption;

abſorption; but if the venereal matter be abſorbed on the thumb or fore finger, it is poſſible that it may not paſs into the glands until it comes into the inſide of the clavicle. Theſe glands being out of our ſight and feeling, the patient may be infected without the ſurgeon ſuſpecting it *.

LYMPHATICS OF THE HEAD AND NECK.

Of the abſorbents of the brain, little is known preciſely; but none can deny the probability, next to an abſolute aſſurance and demonſtration, that the arteries, veins, and lymphatics bear the ſame relations in the brain as in the other parts of the ſyſtem. Lymphatic glands are obſerved in the courſe of the internal jugular vein, and even in the foramen caroticum, which are underſtood to belong to the lymphatics of the brain. The lymphatics of the head are to be obſerved in the courſe of the temporal and occipital arteries; the latter claſs terminate in glands, ſeated behind the maſtoid proceſs of the temporal bone. The lymphatics of the face have been obſerved very numerous accompanying the facial and temporal arteries. But thoſe from the internal parts of the face and noſe accompany the internal maxillary artery, and fall into the glands under the parotid, or in the courſe of that artery. Theſe glands are conſequently liable to diſeaſe, from abſorption of matter of abſceſs in the face, throat, and noſe, and their extirpation is a very hazardous operation. The lymphatics from the gums and jaws alſo accompany the internal maxillary artery, and emerge under the angle of the jaw; and ſome of them joining the external jugular vein, paſs through glands near the top of the ſhoulder. The lymphatic veſſels from the tongue and parts about the os hyoides, take alſo the ſame courſe. To know the GLANDS about the FACE and JAWS are of the greateſt importance to the ſurgeon, for nothing is more common

* Cruickſhanks, p. 182.

than the neceſſity of cutting out indurated lymphatic glands. Theſe are ſometimes miſtaken for diſeaſed ſalivary glands; now the ſalivary glands are rarely diſeaſed, the lymphatic glands often. And it will be a guide to the ſurgeon to enquire into the origin of the induration, (perhaps a ſuppuration in the throat, noſe, or jaws,) and to know preciſely the gland diſeaſed, its depth, and connections.

On the ſide of the face, there are in general ſeveral ſmall lymphatic glands, on the buccinator muſcle, immerſed in the ſurface of the parotid gland, and under the zigomatic proceſs. There are alſo glands to be carefully noted, which lie under the tip of the parotid gland, where it extends behind the angle of the jaw, and alſo lying under the baſe of the jaw-bone, cloſe to the ſub-maxillary gland, and on the courſe of the facial artery.

The GLANDS and ABSORBENTS of the neck are very numerous, and the latter form an intricate and beautiful plexus, ſeveral branches of which are to be obſerved accompanying the external and internal jugular veins. Some of the glands lie immediately under the ſkin, and in the cellular membrane, on the outer edge of the platiſma myoides; many under that muſcle, and in the courſe of the external jugular vein. But there are many ſeated deep, for the greater number accompany the internal carotid artery, and internal jugular vein, or their branches.

The lymphatics of the THYROID GLAND have been raiſed by Mr. Cruickſhanks, by plunging a lancet at random into the ſubſtance of the gland, and blowing into it, or throwing quickſilver into its cellular membrane. The trunks of theſe lymphatics join the thoracic duct on the left ſide; and on the right ſide the right trunk, juſt as it is about to enter into the veins.

OF THE TRUNKS OF THE ABSORBENT SYSTEM.

THE larger and proper trunk of the lymphatic ſyſtem, is generally called the THORACIC DUCT, becauſe it was firſt

firſt obſerved by Pecquet * to be a veſſel which conveyed the chyle through the diaphragm, and which took its courſe through the whole length of the thorax, to throw its fluids into the veins near the heart. Before his time the lacteals which were diſcovered by Aſellius †, were ſuppoſed to terminate in the liver. The firſt diſcoverers of the thoracic duct, deſcribed it as beginning from a pyriform bag, to which they gave the name of RECEPTACULUM CHYLI. In dogs, fiſh, and the turtle, ſuch a ciſtern or bag may be obſerved; but in the human body nothing further is to be obſerved than an irregular dilatation of this veſſel, like a varicoſe diſtention, where it receives the acceſſion of the lacteals from the root of the meſentery. The origin of this great trunk, called the thoracic trunk, is the union of the veſſels, which running by the ſide of the common iliac veſſels, are derived from the pelvis and lower extremities. Upon the third and fourth vertebræ, and under the aorta, this trunk is frequently joined by a large trunk of the lacteals, and then aſcending, it receives the greater number, or the larger trunks of the lacteals. On the vertebræ of the loins, the thoracic duct is by no means regular, either in its courſe or ſize or ſhape; often it contracts, and again irregularly dilates, as it ſeems to emerge from under the aorta. On the uppermoſt vertebra of the loins, the thoracic duct lies under the right crus of the diaphragm, and then paſſing the ſeptum with the aorta, it gets on the right anterior ſurface of the ſpine, and runs up betwixt the aorta and the vena azygos; it then paſſes under the arch of the aorta, and there it is conſiderably enlarged, from the contracted ſtate which it aſſumes in the thorax. Sometimes it ſplits, and again unites on the vertebræ of the back. Having paſſed the arch of the aorta, it croſſes

* In the year 1651.

† In the year 1622.—About the year 1652, the other branches of the ſyſtem, which take their courſe to every part of the body, were diſcovered by Rudbeck, Jolyffe, and Thom. Bartholin.

to

to the left ſide of the ſpine, and we look for it under the pleura on the left ſide of the œſophagus.

The thoracic duct now emerges from the thorax, and lies deep in the lower part of the neck, behind the lower thyroid artery, and on the longus colli muſcle.

It gets above the level of the ſubclavian vein of the left ſide, and here it receives the abſorbents of the head and neck (of the left ſide), and deſcends again with a curve, and terminates in the angle of the union of the ſubclavian vein and jugular vein of the left ſide.

Sometimes there are two thoracic ducts; but this is very rare. Sometimes the duct ſplits near its termination, and the two branches enter the veins ſeparately; but, in general, when it ſplits in this manner, it again unites before it terminates in the vein.

There is conſtantly a trunk in the anterior mediaſtinum under the ſternum, almoſt as large as the thoracic duct itſelf, which is ſometimes inſerted into the termination of the thoracic duct; ſometimes into the trunk of the abſorbents of the left ſide, to be immediately deſcribed *.

THE TRUNK OF THE ABSORBENTS OF THE RIGHT SIDE.

The abſorbents, from the right ſide of the head and neck, and from the right arm, do not run acroſs the neck, to unite with the great trunk of the ſyſtem; they have an equal opportunity of dropping their contents into the angle betwixt the right ſubclavian and the jugular vein. Theſe veſſels then uniting, form a trunk which is little more than an inch, nay, ſometimes not a quarter of an inch in length, but which has nearly as great a diameter as the proper trunk of the left ſide.

This veſſel lies upon the right ſubclavian vein, and receives a very conſiderable number of lymphatic veſſels: not only does it receive the lymphatics, from the

* Cruikſhanks.

right

right ſide of the head, thyroid gland, neck, &c. and the lymphatics of the arm; but it receives alſo thoſe from the right ſide of the thorax and diaphragm, from the lungs of this ſide, and from the parts ſupplied by the mammary artery. Both in this and in the great trunk there are many valves.

OF THE LACTEALS AND LYMPHATICS OF THE INTESTINAL CANAL.

WE ſhall afterwards have to obſerve the great length of the inteſtinal canal, the effect of the imperfect valvular ſtructure, in extending the inner coat to a great length; we have remarked that while every ſurface of the body ſecretes, it is at the ſame time an abſorbing ſurface; and finally, that while we chiefly contemplate the inteſtinal canal, as imbibing and receiving the nouriſhment, we muſt not forget that it is alſo a ſecreting ſurface of the firſt importance to the œconomy. But at preſent we have merely to underſtand that ſtructure and organization, by which this canal abſorbs the nutritious fluid the chyle from the food.

In the firſt place, as to the terms lacteals and lymphatics, we preſume that the abſorbents throughout the whole length of the canal have the ſame ſtructure and uſe; and that the term lacteals has been ſuggeſted merely by the colour of the fluid, which is abſorbed from the ſmall inteſtines. At one time theſe lacteals convey a milky fluid: at another a tranſparent fluid, like that which the ſtomach and great inteſtines in general abſorb.

The lacteals, as it is natural to ſuppoſe, were the firſt diſcovered of any part of the ſyſtem of abſorbents; or, at leaſt, they were firſt underſtood to form a part of an abſorbing ſyſtem. For although Euſtachius, a Roman anatomiſt, diſcovered the thoracic duct in the year 1563, yet he had very imperfect notions of its importance, and the diſcovery was very little attended to, till after the diſcovery of the lacteals by Aſellius in 1622.

 This

This anatomiſt, in opening living animals, to obſerve the motion of the diaphragm, obſerved white filaments on the meſentery, which he took at firſt for nerves; but, on puncturing them, and obſerving them to diſcharge their contents and to collapſe, he proclaimed his diſcovery of a new ſet of veſſels—a fourth kind *.

Had Aſellius only chanced to obſerve theſe veſſels, his merit would have been inconſiderable; but he alſo inveſtigated and announced their peculiar office, viz. of abſorbing the chyle from the inteſtinal canal, and carrying it into the blood.

For ſome time, however, after the diſcovery of the vaſa lactea, the opinion of Hippocrates and Galen, viz. that the meſenteric veins abſorbed the chyle from the inteſtines, and conveyed it to the liver, ſtill prevailed. Even after the diſcovery of the lacteals was known and received, a part of the old ſyſtem was ſtill retained, and it was ſuppoſed that thoſe veſſels carried the fluids abſorbed from the inteſtines into the liver; and that the fluids were there converted into blood.

About twenty years after the diſcovery of Aſellius, Rudbeck, a Swede, and Bartholin, a Daniſh anatomiſt, ſaw Aſellius's veſſels in many other parts of the body; diſcovered the trunk of the ſyſtem, and ſhewed that the lacteals did not paſs to the liver, but that they were branches of a great and diſtinct ſyſtem; they alſo demonſtrated the unity of this ſyſtem.

We have ſeen from this ſketch that the ancients ſuppoſed the veins of the inteſtines to be abſorbents; and even after the diſcovery of the lacteals, this idea has been retained by ſome of the beſt modern anatomiſts, and principally by Haller, and profeſſor Mickel of Berlin. If the veins abſorb from the ſurface of the inteſtines, their doctrine would imply that they are alſo abſorbents in general throughout the body. Although Bartholin, in his epiſtle to Harvey, had aſſerted and given ſufficient proof that the meſenteric veins were not

* The nerves being counted as veſſels.

abſorbents,

abſorbents, yet the controverſy was left in ſo undecided a ſtate, as to give occaſion to the ſeries of experiments in the ſchool of the Hunters, which ſeems to have put the queſtion to reſt, in as far as it is connected with the lymphatic ſyſtem *.

We have already mentioned that Aſellius was employed in opening the belly of a living dog, when he firſt diſcovered the lacteals. He perceived upon the ſurface of the inteſtines and meſentery a great many ſmall threads, which, at firſt ſight, he took for nerves, but ſoon diſcovered his error; and to diſſipate his doubt, opened one of the largeſt white cords, when no ſooner had the inciſion been made, than he ſaw a fluid like milk or cream iſſue from the veſſels. Aſellius ſays he could not contain his joy at the ſight of this phenomenon; and turning himſelf to Alexander Tadinus, and the ſenator Septalius, who were preſent, he invited them to enjoy the ſpectacle;—but his pleaſure, he adds, was of ſhort duration, for the dog died, and the veſſels diſappeared. The natural and ſimple narration of Aſellius repreſents his aſtoniſhment, and gives an idea of the ſenſation, which the anatomiſt experiences in the inſtant of making an intereſting diſcovery †.

ORIGIN OF THE LACTEALS. When the young anatomical ſtudent ties the meſenteric veſſels of an animal recently killed, and finds the lacteals gradually ſwell; when he finds them turgid, if the animal has had a full meal, and if he has allowed time for the chyle to deſcend into the ſmall inteſtines—and empty, or containing only a limpid fluid if the animal has wanted food; he has ſufficient proof that theſe are the veſſels deſtined to abſorb the nutritious fluids from the inteſtines. Again, when coloured fluids are thrown into the inteſtines of a living animal, and they are abſorbed, he has ſufficient proof of their free and ready communication with the inner ſurface of the gut; but the actual demonſtration of the ab-

* See the VEINS in this volume.

† Sheldon, Portal.

ſorbing mouths of the lacteal veſſels is very difficult. The difficulty ariſes from theſe veſſels being in general empty in the dead body, from the impoſſibility of injecting them from trunk to branch in conſequence of their valves; and, laſtly, from their orifices never being patent, except in a ſtate of excitement. The anatomiſt muſt therefore watch his opportunity when a man has been ſuddenly cut off in health, and after a full meal. Then the villi of the inner coat may be ſeen turgid with chyle, and their ſtructure may be examined. Perhaps the firſt obſervations which were made upon this ſubject by Lieberkuhn, are ſtill the beſt and the moſt accurate.

The villi are apparently of a cellular ſtructure, for although they are flat or conical, or like filaments when collapſed; yet when minutely injected, and eſpecially when they are full of chyle, they take a globular form, and are called the AMPULULÆ. Their diſtention, in conſequence of a minute injection of the veins or arteries, is probably owing to a cellular ſtructure (which they ſeem to have) into which the injection has extravaſated. The moſt probable account of the ſtructure of theſe ampululæ is that this cellular ſtructure is a proviſion for their diſtention and erection by the blood, when excited by the preſence of the chyle in the inteſtines; that this erection gives rigidity to the orifice of the lacteals; and that the firſt ſtep of abſorption is by capillary attraction, while the further propulſion of the fluid in the extreme abſorbents is by the contraction of their coats excited by the preſence of the fluid. Thus the abſorption is not by an inorganized pore, but depending on excitement and action.

Lieberkuhn's obſervations of the villi are the moſt accurate and curious. He obſerves, that having opened and waſhed a portion of the ſmall inteſtine, its whole ſurface will be found covered with little pendulous conical membranes of the fifth part of a line in ſize, and the baſes of which almoſt touch each other. From the vaſcular membrane, to which they are attached, he obſerves there is given off to each villus a branch of a lacteal, an artery, a vein, and a nerve. He found it difficult by in-

 jection

jection to ſhew both the vein and artery, the fluid paſſed ſo eaſily from the one into the other. He found that the extreme branch of the lacteal was diſtended into a little veſſel within the villus. And on the apex of which, with the microſcope, he ſaw one or ſometimes ſeveral openings; with his glaſſes he obſerved the arteries to ramify on the globules or ampululæ and again collect into veins; and he ſuppoſed that ſtill more minute branches plunged into the centre. But he made a ſtill more minute obſervation than this. Inſulating a piece of inteſtine betwixt two rings, only leaving a ſpace for the entrance of the ramification of the artery which ſupplied it, he injected with a column, and examined its progreſs at the ſame time with his microſcope. As he raiſed the tube, he ſaw the artery going in ſerpentine turns to the villus, and the injection returning by the veins; at laſt it paſſed into the ampulia lactea, diſtended it and made its exit by the foramina. He prepared the villi in another way:—he inflated the ampullæ, and kept them ſo until they dried; then he cut them with a razor, and found them cellular. This cellular ſtucture Cruickſhanks thinks is the common cellular ſubſtance, uniting the veſſels of the villus. When this gentleman examined the villi of a patient who died ſuddenly after a meal, he obſerved ſome of them to be turgid with chyle, ſo that nothing of the ramifications of the arteries or veins were to be obſerved; the whole appeared as one white veſſel without any red lines, pores, or orifices; others of the villi contained chyle in a leſs proportion; and here the ramifications of the veins were numerous, and prevailed by their redneſs over the whiteneſs of the villi.

In ſome hundred villi he ſaw the trunk of a lacteal forming by radiated branches, one branch in each villus. Mr. Cruickſhanks and Dr. Hunter counted fifteen or twenty orifices in ſome of the villi.

Mr. Cruickſhanks has remarked a deep and a ſuperficial ſet of lacteals on the inteſtines; but for this diviſion there ſeems no neceſſity. Deep in the coats the lacteals ſeem to accompany the blood veſſels; but when they get more

 ſuper-

ſuperficial, they take a courſe longitudinally on the canal, and turn deviouſly, or after running a little way, take a ſudden turn towards the meſentery.

As the greater frequency of the valvulæ conniventes in the jejunum, greatly increaſe the extent of its inner ſurface of the gut, and conſequently give a greater extent of origin to the lacteals; and, as here the chyle muſt be in the greater quantity, ſo the lacteals of this portion of the gut are larger and more numerous than in any other part of the extent of the canal.

The lacteals do not attach themſelves to the veſſels of the meſentery, but take a more ſuperficial courſe. Before they enter the meſenteric glands, they have been called lacteals of the firſt order; when they emerge from the firſt into the ſecond glands, ſecondary lacteals, or glands of the ſecond order. The manner of their entering and going out of glands is exactly the ſame with that of the lymphatics. The lacteals (or perhaps we ſhould now ſay the abſorbents merely) of the great inteſtines, are ſmaller and leſs numerous than thoſe of the ſmall inteſtines; for although the inteſtines be large, ſtill their inner ſurface is by no means ſo extenſive: beſides the chyle is abſorbed, and the contents of the gut altered before they have deſcended into the great inteſtines. Both Winſlow and Haller, however, aſſert, that they have ſeen chyle in the abſorbents of the great inteſtines. We know that the lacteals abſorb chyle, when it is preſented to them: while at other times they abſorb other fluids. That the abſorbents of the great inteſtines imbibe the fluid's contents is evident, from the change produced on the fæces in their paſſage. Copious and nutritious injections have been given, which did not return in the ſame liquid form, and which have ſupported the ſtrength for ſome time. Clyſters of turpentine give the urine a ſmell of violets; and the Peruvian bark has cured fever, when given by the rectum.

The abſorbents of the ſtomach form three diviſions: one ſet accompanies the coronary artery and vein, and enters the glands on the leſſer curvature and omentum minus.

minus. Thofe of the fecond fet accompany the left gaftro-epiploic artery, and are joined by the lymphatics of the omentum. The third pafs down upon the upper part of the duodenum following the arteria gaftrica dextra: thefe defcend to pafs into the fame clafs of glands, which receive the lymphatics of the liver. They are joined in their courfe by the lymphatics of the right fide of the omentum.

The lacteals on the mefentery pafs from one gland to another till they form one or two large trunks only. Thefe accompany the trunk of the fuperior mefenteric artery, and run down on the right fide of the aorta, and join the thoracic duct. The abforbents, from the rectum and colon of the left fide, pafs into their glands, or fometimes into the lumbar glands, and join the thoracic duct feparately; thofe from the right fide of the colon join or mingle with the lacteals in the root of the mefentery.

OF THE REMAINING ABSORBENTS OF THE SOLID VISCERA.

WHERE the lymphatics of the lower extremity defcend over the brim of the pelvis, they are joined by the abforbents of the bladder, veficulæ feminales, and other parts in the pelvis:—fmall glands belonging to this fet are attached to the internal iliac veffels. In the female, the lower fet of lymphatics, from the womb and vagina, alfo come by this route to join thofe of the lower extemity, or run mingling with them. Another fet of lymphatics of the womb pafs up with the fpermatic veffels.

The lymphatics of the TESTICLE are very numerous. They come in diftinct fets from the body of the tefticle, from the epidydimis, and from the tunica vaginalis: then reaching the cord, form fix or ten trunks, and run up direct to the abdominal ring; paffing the ring, they turn outward, and then pafs over the pfoas mufcle and into the lumbar glands.

 The

The lymphatics of the KIDNEY are in two ſets, ſuperficial and deep-ſeated; but the former are ſeldom to be obſerved. Sometimes diſeaſe makes them diſtinct. The internal lymphatics are demonſtrated by blowing into the veins, or tying a ligature and kneading the ſubſtance of the kidney with the fingers; when they riſe, they are ſeen attached to the emulgent veſſels, and go to join the lumbar glands, or terminate in large lymphatics near the aorta.

It is needleſs to repeat that the abſorbents of the ſpleen are deep and ſuperficial,—for this arrangement is general. Emerging from the ſpleen, the lymphatics paſs alongſt the ſplenic veſſels, and enter into glands attached to the ſplenic artery in its whole courſe. In this courſe they receive the abſorbents from the pancreas, and near the head of the pancreas, they are blended with thoſe of the liver, and with them join the thoracic duct.

The lymphatics of the liver are the moſt eaſily detected, and may be injected to greater minuteneſs, than in any other part of the body. Although they have many valves, yet they do not ſeem to cloſe the veſſels intirely, nor interrupt the mercury from paſſing from trunk to branch. The ſuperficial lymphatics, which are ſo numerous that we may ſometimes ſee the mercury in them covering completely a conſiderable ſpace, have free communication with the internal ſet of veſſels which are alſo numerous and large. The principal route of the lymphatics of the upper ſurface of the liver, is by the broad ligament: theſe perforating the diaphragm join the trunk, which we have noticed under the ſternum, and in the anterior mediaſtinum. It would appear however, that theſe lymphatics of the broad or ſuſpenſory ligament, are by no means conſtant and uniform in their courſe: for ſometimes they run down towards the lateral ligament, and perforate it there; ſometimes they paſs down into the thoracic duct while ſtill in the belly. Other lymphatics of great ſize, run off from the convex ſurface of the liver upon the lateral ligaments, and pierce the diaphragm. The lymphatics on the lower or concave

ſurface

ſurface of the liver are more irregular than thoſe of the convex ſide. They unite with the deep lymphatics coming out of the porta alongſt with the vena portæ, enter into the glands, which are ſeated on the trunk of that veſſel, and join the thoracic duct near the root of the ſuperior meſenteric artery.

The lymphatics of the LUNGS are nearly as numerous as thoſe of the liver; but, indeed, in regard to this expreſſion, it is more in relation to the facility of injecting and demonſtrating the lymphatics, than to their comparative number. For example, if the lymphatics of the other viſcera could be injected to as great minuteneſs as thoſe of the liver, we ſhould ceaſe to conſider that viſcus as more abundantly ſupplied than other parts. The ſuperficial lymphatics of the lungs form areolæ, and cover the ſurface almoſt completely. They take a courſe to the root of the lungs, where they are joined by the deep-ſeated veſſels, and together paſs into the bronchial glands, and here the lymphatics of both ſides freely communicate.

The glands of the lungs are conſtantly found both before and behind the bifurcation of the trachea: often theſe glands are of a very dark colour; nay, their ſubſtance is ſometimes found reſolved as it were into a ſac of inky-like fluid. Upon the arch of the aorta, and the root of its great branches, are the CARDIAC GLANDS, which receive the lymphatics from the heart. The abſorbents of the heart are ſmall, but very numerous, and their larger branches attach themſelves to the coronary veſſels. They then paſs to the cardiac glands, and mingling with thoſe from the lungs, join the thoracic duct.

INTRODUCTORY VIEW

OF THE

NERVOUS SYSTEM.

THERE can be no natural diviſion of the nervous ſyſtem, for it is a whole ſo connected in function, that no one part is capable of receiving or imparting any ſenſation, or of performing the operation of the intellect.

The ſyſtem has, notwithſtanding, been arbitrarily divided into the brain and nerves; the brain being ſubdivided into the cerebrum, cerebellum, and medulla oblongata; while the nerves are ſubdivided into the nerves of the ſenſes, the vital and involuntary nerves, the nerves of voluntary motion.

The BRAIN is defined to be that ſoft maſs contained within the cranium, from which the nerves are propagated to the organs of the ſenſes and over the body, beſtowing ſenſation, and acting as the agents of the will. It is believed to be the receptacle of ſenſation and the inſtrument of thought; but our ideas of its functions are vague and imperfect.

The ſubſtance of the brain is delicate and ſoft, having a ſlight degree of elaſticity, but the nerves are firm and hard, and the elaſticity they poſſeſs is in their membranes, while the matter of the nerve is ſo diſpoſed, as to be undiſturbed by their motion. It is their membranes which give them firmneſs and ſtrength to enable them to paſs through the moving parts of the body without being bruiſed, or having their function affected. The brain is protected

protected and supported by the scull and dura mater; its peculiar matter is supported and nourished by the pia mater. The nerves contain the same matter with the brain; but in their course through the body this matter is disguised by the peculiar structure of their membranes, which, while they support this substance, nourish it also by conveying vessels to it, as the pia mater does to the brain. But the extremities of the nerves are again reduced to the same delicate texture with the brain.

In the structure of the brain and nerves there is an analogy with the other parts of the body. In a bone or a muscle there is the same intertexture of membranes supporting the peculiar substance which is the characteristic of the part, and conveying blood vessels for its nourishment. The muscular fibres, or the earth of bone, are, in the midst of this investing membrane, peculiar parts distinct in their properties, as the medullary substance of the nerves is amidst the cellular membrane, which divides it into fasciculi, and produces the fibrous appearance.

The nerves are cords extending to every sensible part of the body, and the sensibility results from the perfection of their function, and their continuity with the brain.

When it is said that the nerves are productions of the brain, we are not to understand that they are propagated from it to the distant parts of the body, as if drawn out from it like a thread from the flax. In the embryo the nerves are laid in their sheaths, extending to the remotest parts of the body. They are connected with the brain, and in this sense they may be considered as elongations of it, the perfect function of both depending upon their union.

When the trunk of the nerve of a limb is cut, it is only deprived of its connection with the brain, the centre of the nervous system; and little further effect is produced than the loss of sensation, and the destruction of the powers of the will over the limb: the nutrition and growth of the part continue, and the action of those parts, which are independent of the will, as the muscular power of the vessels of the limb, remains entire.

When

When a cut nerve re-unites, the power of motion is reſtored, but the ſenſation of the part is loſt * When a nerve has been cut acroſs, the irritation of the cut extremities produce acute ſenſation, which is demonſtration that the nerves are not tubes containing fluids: for then would this fluid eſcape, and the nerve loſe its power ?—Modern phyſiologiſts ſpeak with affected moderation of the weakneſs of former opinions, and conclude that it is far more probable that the nervous fluid reſembles the electric fluid, and that it is retained in the nerves like the electric matter in electric bodies, viz. by communication and inſulation, that the nerves are the ſole conductors, the other parts of the body cohibent ſubſtances. A weak analogy as any which have been hitherto received as doctrines. If there was a fluid in the brain and nerves like the electric fluid, then would the contact of cut nerves reſtore ſenſation, and indeed in that caſe ſenſation might be communicated from one individual to another. The properties of life are like to nothing inanimate, do not admit therefore of illuſtration by things familiar, and analogy here always miſleads. The weakeſt and therefore the boldeſt opinion lately offered, is that envelopes of the nerves were the moving powers to the muſcles, and that the medullary matter conveyed ſenſation. The opinion that the nerves poſſeſs a muſcular power, has little foundation.

The nerves of animals are in proportion to the ſize of their bodies; but in many of the great tribes of animals the brain bears no ſuch proportion. The nerves of the organs alſo bear a relation to the neceſſities of the animal, and the perfection of the external organ, not to the ſize of the brain. If the procuring of ſuſtenance depend upon the power of the organ of ſmelling, or upon the ear, or the eye, or even the bill, an additional ſupply of nerves is provided, or a peculiar apparatus of nerves, ſuited to the want.

Looking to the ſtructure and courſe of the nerves, we are led to conclude that they are analagous to the brain;

* *Cuvier.*

that

that they conſiſt of matter ſimilar in ſtructure and function to it, diffuſed over the body, and included in the pia mater, or in a ſimilar delicate and vaſcular membrane, and that their proper ſubſtance conſiſts of matter like the brain, and nouriſhed in the ſame way. We muſt conclude alſo, that they are more independent of the brain than the brain is of them; for the nerves are capable of continuing the operations of the animal body independently of the brain; but without the communication of ſenſation through the nerves to the brain, its function muſt be totally unexerciſed *.

The nerves, in their courſe through the body, form ganglions, plexus, and net-works. By theſe a more univerſal connection of the ſeveral branches of the ſyſtem is maintained, ſo that few if any nerves can be traced to one point or origin. When the nerves form ganglions, (which are like knots or ſwellings upon them,) their fibres are ſplit and irregularly diſperſed, while there intervenes a peculiar ſubſtance reſembling the ſtriæ of the cineritious ſubſtance in the brain †.

I do not know that any one in this country has of late years attended more than I have done to the diſtribution and connection of the nerves. But after all I am inclined to believe that the conſent or ſympathies of parts proceeds from connections eſtabliſhed in the brain, and that they do not reſult from the interchange of filaments in their courſe through the body ‡.

The nerves are not ſent over the body like the arteries. If arterial blood be ſent to a part, it ſignifies not by what branch or circuitous rout that blood comes.

* Children have been born without the brain, and have lived ſome time. Act. Nat. Cur. Dec. 1. An. 8. p. 107. Hiſt. de l'Acad. R. des Scienc. 1704. p. 29. and 1713. p. 27. Hall. Opuſc. Anat. ix. p. 281. De infant. ſine cerebro editis vide Morgagni Adverſ. ii. xxxv.

† Monro. See alſo on this ſubject Mickel Acad. Berolinen. and Zinn. ibid. and An. Anat. Anton. Scarpa de Structura & Uſu Gangliorum. Gottlieb Haaſe de Gangliis Nervorum. Morgagni de Structura Uſuque Gangliorum. Adverſar. Anatom.

‡ Scarpa comes to a different concluſion. See Annot. Anatomic. p. 110.

On

On the contrary, in the nervous ſyſtem, the peculiarity of function or of ſenſation reſults from the particular nerve, and the connection of that nerve with the brain. However, it is more common to ſay that in their extremities the nerves are peculiarly organized: that a nerve, in its courſe, is incapable of receiving any diſtinct ſenſation; that when injured, it conveys to us the undefinable ſenſation of pain; and from the connection with the muſcles, and with the whole ſyſtem, it ſhakes the limb with involuntary tremors, or ſudden ſpaſms. And ſo it is ſaid, that the ſuſceptibility of thoſe peculiar impreſſions which the organs of the ſenſes convey, depends upon a ſtructure diſtinct from that of the brain, and diſtinct alſo from that of the nervous cords; and this organization is ſo peculiar, that the nerves of one ſenſe are quite incapable of receiving the impreſſions which thoſe of another are fitted to convey, though apparently to our reaſoning thoſe impreſſions appear to be capable of producing a ſtronger effect upon the nerves.

As the vital organs muſt be in perpetual action to ſupport life, nature has guarded thoſe functions by making them independent of the will, and leſs immediately dependent on the function of the brain. Nerves are ſent to the vital parts forming a diſtinct claſs from the nerves of ſenſation, or the nerves of voluntary motion. This is a proviſion which allows the exhauſted mental functions and the powers of the muſcles to be recruited by ſleep, while the operations of the animal œconomy neceſſary to life go on uninterrupted.

But yet it may be neceſſary to ſtate here, that although the brain has no ſuch power over the vital parts as it has over the voluntary muſcles, and although the vital parts poſſeſs little ſenſibility, yet there is a reciprocal influence betwixt the nerves and the vital organs. Violent paſſion, and eſpecially continued grief and intenſe ſtudy alters the ſtate of the ſecretions, and diſorders digeſtion; while a loaded ſtomach blunts the faculties, and weakens ſenſibility, and if long continued, does not merely induce to ſleep, but permanently injures the mobility of the nervous ſyſtem. We muſt be ſenſible how often the exerciſe of the paſſions, and even the images which occupy the mind, produce phyſical changes on the body; and again, a very principal part of pathology is to trace the conſequences of diſorder in the groſſer bodily functions in their effects upon the mind *.

As in ſleep the vital functions continue uninterrupted, ſo the diſeaſes of the brain, which reſemble ſleep, ſuddenly deprive the body of all voluntary exertion, while the vital motion remains for a time unimpaired, and ſinks gradually, for no part of the body is altogether independent of the healthy function of the brain.

It is neceſſary alſo that we ſhould recollect the connection of the higher attributes of a living being with the animal œconomy.

The brain, the nerves, and the nervous expanſions in the organs of the ſenſes, are dependent for the perpetual

* In Parturientibus Iræ Effectus. Vide Sandifort Theſaur. vol. iii. p. 331. 543. n. 589.

renewal and ſupport of their function upon the circulation of the blood. We ſhould be tempted to imagine, that the nervous ſyſtem were a nobler part of the œconomy not liable to change by the groſſer operations of the animal machine, did we not frequently ſee the powers of the mind as well as the functions of the nerves diſturbed, or altogether overthrown by the irregularities of the bodily ſyſtem; were we not thus reminded of that circle of connections and mutual dependencies which ſupport the whole. If the blood flows too rapidly upon the brain, the intellect is diſordered, the ideas come in rapid and irregular ſucceſſion. If the exit of the blood from the head be obſtructed, there is an obſtruction to the circulation of the blood in the extremities of the veſſels of the brain; the function of the brain is ſuddenly ſuppreſſed, becauſe, though its attributes ſeem ſo peculiar, it requires the perpetual circulation of the blood through it to ſupport its powers.

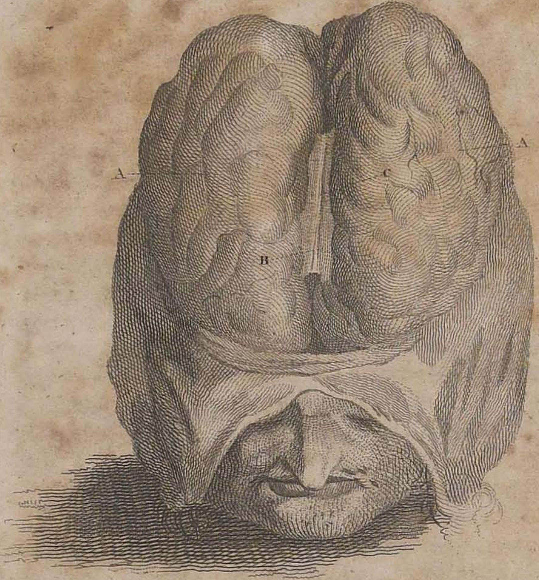
The effect of the circulation of the blood through the nerves of the limb is not leſs remarkable. If the nerve of a limb be cut or tied, the animal can no longer move the limb, having loſt the power of the will over it. But if the great artery of a limb be tied, the function of the nerve is, in a ſhort time, equally deſtroyed, becauſe the circulation of the blood through the nerve being obſtructed, it loſes its powers, and is no longer a living part.

Thus, whilſt the moving powers of the circulation of the blood are dependent on the ſtate of the nervous ſyſtem, the nervous ſyſtem is as immediately dependent on the healthy ſtate of the blood, and the velocity of the circulation.

The general concluſion to which we are naturally brought is this. The viſcera of the abdomen ſupply the matter of the blood. The viſcera of the thorax perfects the blood and ſends it over the body to ſuſtain in the body the principle of life; and this principle of life is ſenſibility, and is ſeated in the nerves, though powerfully influenced by the circulation. Whilſt the ſenſibility of the body, each part to its peculiar ſtimulus enables

ables the whole to exiſt in activity: it is more important to obſerve how the brain and nerves give us external relations; indeed, the whole operations of the animal œconomy are to ſuſtain, through the brain and nerves, a ſentient intelligent being.

With this general view of our ſubject, we proceed to inveſtigate the anatomy of the brain as a diſtinct part, without forgetting the unity of the ſyſtem.



A.A. *Hemispheres of the Cerebrum*
B. *Corpus Callosum* C. *Rapha*

CHAP. I.

OF THE MEMBRANES OF THE BRAIN, AND OF THE SUBSTANCE AND TEXTURE OF THE BRAIN ITSELF.

OF THE DURA MATER.

MANY authors, while they deſcribe the cranium as containing the brain, conceive that it alſo gives its ſhape. But the brain is formed before the bones which inveſt it. The firſt thing that we obſerve in the embryo is the diſproportionate ſize of the brain to the diminutive body. The oſſification of the bones of the ſcull

the Scull-cap of a Child before it be fully Ossified ..1 the Fontanelle : 2 the Perecranium extremely: Vascular..3 the Longitudinal Sinus opened by cutting up the membrane in the direction of the Sagittal Suture

ſcull is a gradual proceſs. The brain, already formed, is inveſted with the ſtrong membranes; and betwixt the laminæ of the outer membrane the points of oſſification commence, and are not completed until the ninth year. The bony matter, which is depoſited betwixt the layers of this membrane, retains a firm connection and interchange of veſſels with the now apparently diſtinct membranes on its inner and outer ſurfaces. The outer layer, which is ſo ſtrong in children newly born, becomes the delicate pericranium, whilſt the inner layer is the dura mater. Thus we find that the bones of the head are moulded to the brain, and the peculiar ſhapes of the bones of the head are determined by the original peculiarity in the ſhape of the brain.

This view corrects an error into which many have fallen, that the dura mater and the veſſels ramifying upon it impreſs their form upon the ſolid bones, and wear channels upon their ſurface by their inceſſant pulſation. The membranes and veſſels precede the formation of the bone, and the oſſeous matter is depoſited ſo as to be moulded round the veſſels *.

Thus the dura mater may be conſidered as the internal pericranium †.

The dura mater ‡ is a firm and ſomewhat opaque membrane.—When the ſcull-cap is torn off, and it is cleaned from the blood which eſcapes from the ruptured veſſels, it is ſeen marbled with azure and roſy colours. It partakes more of the former in youth than in thoſe

* Albini Acad. Anat. "Quomodo cranium creſcendo accomodat ſe eis quæ continet."

Fiſcher, Diſſertatio de modo, quo, oſſa ſe vicinis accomodant partibus.

† Some regard only its external lamina as the internal pericranium. Haller t. iv. p. 92. Fallopius firſt viewed the dura mater in this light, and he is followed by the beſt anatomiſts.

‡ The membranes of the brain have the name of *mater*, becauſe they defend the brain, and protect its tender ſubſtance; or according to ſome anatomiſts of the Arabian ſchool, becauſe the other membranes of the body are produced from them. Before Galen, the term Meninx was common to all the membranes of the body, afterwards it was appropriated to thoſe of the brain.

 advanced

advanced in years, or in the robuſt and ſanguineous *. Its outer ſurface is rough, from the adheſions to the bone being torn up; but on the ſurface lying in contact with the brain, it is ſmooth, ſhining, and of a pearl colour.

Although the dura mater is really the ſtrongeſt membrane of the body, it is yet diviſible into laminæ; theſe are ſtrengthened and firmly connected by the intertexture of ſtrong fibres. Moſt anatomiſts deſcribe it as compoſed of two laminæ †. Some, however, deſcribe three laminæ—the outer lamina, or ſquamoſa; the middle, or filamentoſa; and the internal (being ſmooth and uniform), the lamina membranoſa ‡. But to ſeparate the dura mater into ſuch laminæ, it will, I believe, be neceſſary to dry it and tear it into ſhreds. No doubt it may be poſſible thus to tear it, as ſome have done, into four, ſix, ſeven, or even eight laminæ or ſquamæ. It is to be regretted that anatomiſts ſhould have been proud of ſuch diſſections.

The dura mater is inſenſible; it has, in the way of experiment, been pricked and injured by every poſſible contrivance, by mechanical and by chemical ſtimulants; yet the animals, the ſubjects of ſuch cruel experiments, have given no ſign of pain §. Before this fact of the inſenſibility of the dura mater was thus eſtabliſhed, phyſicians regarded this membrane as the ſeat and origin of many diſeaſes ‖.

* Malacarne Encefalotomia Nuova, p. 19.

† Soemmerring Corp. Hum. Fabrica, t. iv. p. 26. Haller, t. iv. p. 91.

‡ Malacarne, p. 22. It is deſcribed as partly tendinous, partly ligamentous: that is to ſay, of a nature reſembling theſe, yet not altogether the ſame. Vicq d'Azyr found it ſeparated by purulent matter into two laminæ, the fibres of which had a different direction. Acad. de Sciences, An. 1781. p. 497.—Bartholin Sp. Hiſtor. Anatomiæ.

§ Zinn. Exper. circa corpus calloſum, cerebellum, duram meningem.—Mem. par Haller ſur les parties ſenſibles et irritables.—Blegny Journal de Med. An. 1. p. 16.

‖ See Hoffman. Med. Ration. part 2. ſec. ii. c. 1. § 2. and Boneti Sepulch. Anat. lib. i. ſec. i.

Formerly

Formerly the natural connection of the ſcull and dura mater was ſo reſolutely denied—ſo hotly conteſted among the various parties in anatomy and ſurgery, that we might, by reading their diſputes, almoſt doubt one of the plaineſt and moſt obvious facts, were not the cloſeneſs of this connection ſufficiently proved by the manner of the original formation of the cranium, by the reſiſtance to the tearing up of the cranium, and by the bleeding ſurface of the dura mater; or, if further proof be required, we may macerate theſe bones and their membranes in acids, when the laminæ of the dura mater will be ſeen intimately connected with the bone, while the pericranium and outer laminæ of the dura mater are ſeen to be continued into each other *, by the intermediate cellular texture in which the earth of the bones was lodged †.

The dura mater adheres more firmly to the bone in young ſubjects, becauſe the bone is yet imperfect, and its ſurface ſpongy and rough; and, for the ſame reaſon, it is more firmly attached to the ſcull in the chronic hydrocephalus, becauſe the oſſification is imperfect.

It frequently adheres ſo firmly to the ſcull-cap, as to leave its outer lamina adhering to the ſcull when it is raiſed. The dura mater is a ſimple membrane as far as it is poſſible, while every membrane is made up of cellular tiſſue.

GLANDS OF THE DURA MATER.

Upon the external ſurface of the dura mater there are little holes, from which emerge fleſhy-coloured papillæ, and which, upon examining the ſcull-cap, will be found to have correſponding foveæ. Theſe are the

* Vicq d'Azyr Memoir. de l'Acad. Roy. 1781, p. 497, and Malacarne (Aderenze della D. M. alle pareti interne del cranio), p. 24.

† Taking a portion of the dura mater betwixt the finger and thumb, we can move the two lamina upon each other, owing to a ſlight degree of laxity in the connecting cellular ſubſtance. This cellular texture is demonſtrated by Malacarne, by forcibly injecting quickſilver betwixt the layers of the membrane.

 glandulæ

glandulæ Pacchioni *. They are in number from ten to fifteen † on each ſide, and are ſeen chiefly lateral to the courſe of the longitudinal ſinus. Theſe bodies were ſuppoſed by Pacchioni to be glands. When preſſed they give out a fluid ‡; but in this they do not differ from the looſe common cellular membrane. As they are chiefly ſeen along the line of the great ſinus, and are not ſcattered over the whole dura mater, their ſuppoſed uſe of moiſtening the ſurface of the membrane § is quite improbable; and, indeed, this is a part of that unfounded hypotheſis which ſuppoſed an interſtice betwixt the dura mater and ſcull, and aſcribed motion to this membrane. The ſurfaces of the dura and pia mater, where they are in contact, being of the nature of the ſecreting ſurfaces of the inveſting membranes of the other viſcera, require no ſuch further aid in moiſtening them, or preventing their adheſion. Many glands are deſcribed by authors in the ſubſtance, and upon both ſurfaces of the membrane. Of the bodies which adhere to the ſurface of the pia mater, and of thoſe alſo which are to be ſeen in the ſinuſes, we ſhall ſpeak afterwards, when conſidering the veins which enter the longitudinal ſinus.

ARTERIES OF THE DURA MATER.

THIS membrane muſt neceſſarily be ſupplied with veſſels for its own nouriſhment, for that of the contiguous bone, and for the perpetual exudation of the fluid, or halitus rather, which moiſtens or bedews its internal ſurface. We may divide the arteries of the dura mater into anterior, middle, and poſterior. The firſt proceeding from the ophthalmic and ethmoidal branches of the internal carotid; the ſecond from the

* See M. Littre Acad. Roy. des Sciences, 1704. Hiſt. p. 32. art. 19.

† Haller, El. Phyſ. p. 106. Mem. par M. Vicq d'Azyr. Mem. de l'Acad. Roy. 1781, p. 497.

‡ Malacarne.

§ Viz. the opinion of Fantonius.

internal maxillary and ſuperior pharyngeal; the poſterior from the occipital and vertebral arteries and poſterior auris *.

The principal artery of the dura mater, named, by way of diſtinction, the great artery of the dura mater, is derived from the internal maxillary artery, a branch of the external carotid. It is called the ſpinalis, or ſpheno-ſpinalis, from its paſſing into the head through the ſpinous hole of the ſphenoid bone; or meningea media, from its relative ſituation, as it riſes in the great middle foſſa of the ſcull. This artery, though it ſometimes enters the ſcull in two branches †, uſually enters in one conſiderable branch, and divides ſoon after it reaches the dura mater into three or four branches, of which the anterior is the largeſt; and theſe ſpread their ramifications beautifully upon the dura mater, over all that part which is oppoſite to the anterior, middle, and poſterior lobes of the brain. Its larger trunks run upon the internal ſurface of the parietal bone, and are ſometimes for a conſiderable ſpace buried in its ſubſtance. The extreme branches of this artery extend ſo as to inoſculate with the anterior and poſterior arteries of the dura mater, and through the bones (chiefly the parietal and temporal bones) they inoſculate with the temporal and occipital arteries ‡.

The meningeal artery has been known to become aneuriſmal and diſtended at intervals, it has formed an aneuriſm, deſtroying the bones, and cauſing epilepſy §.

OF

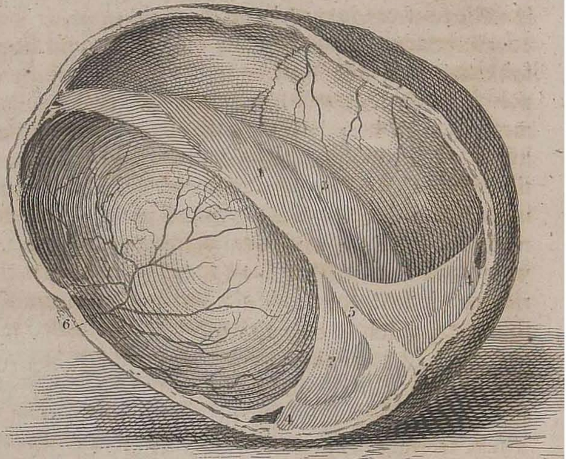
* Soemmerring, C. H. Fabric. A. Murray, Deſcrip. Arteriarum, in tab. redact.

† Soemmerring de Corp. Hum. Fab. tom. v. p. 142. This is not the ſole artery ſent to the dura mater from the internal maxillary, a twig alſo riſes from that branch which goes to the pteregoid muſcles and parts about the Euſtachian tube—it enters the ſcull, and is diſtributed to the fifth pair of nerves, and to the dura mater and cavernous ſinus. Another enters with the inferior maxillary nerve by the foramen ovale, and riſes upon the dura mater.

‡ Malacarne.—Soemmerring, tom. v. p. 142.

§ Malacarne, p. 1. ſec. 105. " Poſſono le arterie, della D. M. " devenire aneuriſmatiche, il che ho veduto in due craнii, in uno dei " quali l'arteria ſpinoſa era tutta gozzi tanto a deſtra quanto a ſiniſtra, " i mag-

The Scull Cap with the D.M. adhering.



1. *Falx*. 2. *Tentorium*. 3. *Longitudinal Sinus*
4.4. *great Lateral Sinuses*. 5 *Fourth Sinus*
6. *artery of the D.M.*
D. Lizars. Sculp.

OF THE SEPTA WHICH INTERSECT THE BRAIN.

THOSE ſepta, or, as they are called, proceſſes of the dura mater, being extended acroſs from the internal ſurface of the cranium, ſupport the brain in the ſudden motions

" i maggiori dei quali (ed erano cinque dal primo, e nove dall' altero " lato) poco ſuperavano la groſſezza dei piſelli : nell' altero ancor gio- " venile ſi vedevano due ſoli gozzi uguali in diametro al mignolo ſul " tronco mezzano dell' arteria ſpinoſa rempetto alla meta del parietale " ſiniſtro, diſtanti nove linee circa l'inferior anteriore dall' altro." Part i. § 105. We have alſo the following caſe from Malacarne. " Juvenis ætatis 22 annorum, ſanguinei temperamenti, poſt vehe- " mentiſſimos, et frequentes epilepſiæ motus in noſocomio D. Joan- " ni

motions of the body, and prevent the mutual gravitation of its parts; but I believe they are chiefly uſeful in retaining the ſinuſes in their triangular form.

Theſe partitions are formed by the reflection of the internal lamina of the dura mater.

The falx is the largeſt of the partitions; it is attached to the cranium in the line of the ſagittal ſuture, and reaching from the criſta galli of the ethmoid bone to the middle of the tentorium, or to the crucial ridge of the occipital bone, it paſſes deep into the middle of the brain, and divides it into its two hemiſpheres. It is in ſhape like a ſcythe, for anteriorly it does not paſs ſo deep into the ſubſtance of the brain; but it gradually becomes broader, or deſcends deeper betwixt the hemiſpheres, as we follow it backwards, which, with the curve, it neceſſarily takes from the ſhape of the cranium, has obtained it the name of falx: it is alſo called ſeptum ſagittale, verticale, or mediaſtinum cerebri *.

" nis, tumente in ſumma bregmatis oſſium parte capitis cute, ſub " meis oculis moriebatur. D. Caccia in hac noſtra univerſitate tunc " Botanices profeſſor, quem mihi patronum a morte peremtum adhuc " defleo, ut cadaver aperiretur juſſerat, atque in ejuſdem capite ex ea " parte, qua tenuiſſima devenerant oſſa, ob arteriarum ſubrepentium " inter duræ matris laminas aneuriſmata, os quoque omnino deficiens " reperiebatur, ſub capitis integumentis aneuriſmata magnitudinis " ovi columbini, exiguo, perruptoque foramine aperto, ut ſanguis ſub " integumentis concreviſcet; atque tunc novimus ad ea aneuriſ- " matum loca, quæ quidem utrinque erant, in vehementia morbi " ægrum pugnos infligere conſueviſſe."—We have ſeen blood under the bone from this artery: and a deſtruction of the bone by what is called fungus of the dura mater, and this middle artery opened by an arrow which ſtuck in the parietal bone, but there is much difficulty in underſtanding how ſo ſmall an artery in the circumſtance of meningea media can form a proper aneuriſm. In the caſe of this artery opened by the arrow, the ſurgeon was cautious of applying preſſure, leſt the blood ſhould force its way betwixt the dura mater and bone, or diffuſe itſelf upon the ſurface of the brain; he bled the boy largely in the arm, but it had no effect upon the hæmorrhagy; and fearing to bring on a greater degree of inflammation by applying the trepan, he made a ſlight compreſſion, and in the now languid ſtate of the circulation, the bleeding was ſuppreſſed.

* The falx has not been found in ſome ſubjects. Garengeot Splanchnologie,—Mr. Carliſle, Medical Tranſactions, 1793.

The

The TENTORIUM ſeparates the cerebrum and cerebellum. It ſtretches horizontally over the cerebellum, and ſuſtains the poſterior lobes of the cerebrum. It is formed by the inner lamina of the dura mater, reflected off from the os occipitis along the whole length of the grooves of the lateral ſinuſes, and the edge or angle of the temporal bones. This ſeptum, thus running round the cavity of the cranium, divides it into two departments; the upper one for the lodgment of the cerebrum, and the lower for the cerebellum. But to allow the union of theſe two great diviſions of the encephalon, a circular opening is left upon the anterior part of the tentorium, which is called the notch of the tentorium.

There is a little proceſs of the dura mater which may be called the FALX of the CEREBELLUM. It runs down upon the internal ſpine of the occipital bone from the tentorium, gradually contracting until it terminates on the margin of the great occipital foramen. It ſerves as a kind of ligament ſtrengthening the tentorium, while it divides the cerebellum. It enters, however, but a little way betwixt the lobes.

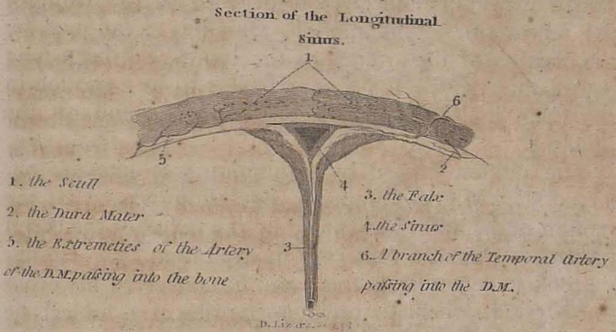
The falx and tentorium being connected and continued into each other at their broadeſt part, they mutually ſupport each other, and are quite tenſe. This tenſeneſs depends on their mutual ſupport, for when one of them is cut, the other falls looſe *.

The lateral extremities of the tentorium are continued forward into acute lines, formed by the duplicature of the dura mater coming off from the edges of the pars petroſa of the temporal bones, and take firm hold on the poſterior clynoid proceſſes. From theſe two points a fold of the membrane ſtretches forward on each ſide to the anterior clynoid proceſs, forming thus a hollow or cell for the lodgment of the pituitary gland. Another fold or duplicature of the dura mater runs onwards a little way from the edge of the little wing of Ingratius. Theſe are the SPHENOIDAL FOLDS.

Where the internal lamina of the dura mater forſakes

* Monro.

the external to form the falx and tentorium, it leaves a channel or triangular canal; the baſis of which triangle is the lamina of the membrane inveſting the cranium, while the tenſion of the partitions carries the apex out into an acute point. This forms a channel for receiving all the blood of the veins, and this tenſion and triangular ſhape gives a degree of incompreſſibility to the canals. Theſe are the ſinuſes which receive the veins of the encephalon, and guard them from compreſſion ;—



Upon the ſurfaces of the dura mater there are many lacerti, or ſlips of fibres, which are interwoven with the main body of the membrane, and ſtrengthen it. Theſe fibres are peculiarly ſtrong in the angles, where the duplicatures paſs inwards, giving firmneſs to the ſinuſes, while they allow the veins to inſinuate their trunks betwixt them; theſe faſciculi, or ſlips of fibres, on the ſides of the ſinuſes, are the cordæ Williſianæ. They were conſidered by Baglivi and Pacchioni * as the tendons of the muſcles of the dura mater, Pacchioni conceiving that this membrane was muſcular. Vicq d'Azyr obſerves, that in inflammation of the dura mater he has ſeen it red, and of a fleſhy appearance; and that ſuch a circumſtance

* Theſe were Italian anatomiſts. Pacchioni was phyſician to Clement the XI.

might

might have deceived Pacchioni, and made him believe that there were mufcular bellies *.

Thefe phyficians conceived that the contraction of the falx and dura mater raifed the tentorium; they even conceived that the action of the heart depended upon this motion of the dura mater †. They were deceived by the pulfation in the arteries of the brain, communicated to the dura mater, after the operation of trepan, or in their experiments on living animals ‡.

The motion communicated to the dura mater thofe Italian anatomifts conceived to depend on the rifing of the tentorium. This motion, which is occafioned by the beating of the arteries of the brain, had been long before obferved §: fome conceived it to be a motion in the brain itfelf, others believed it to depend on the finufes ||.

The motion caufed by refpiration was likewife obferved ¶. M. de Lamure's conclufion was, that the motion of the brain was caufed by the reflux of the blood towards it from the vena cava in expiration **. He undertook to demonftrate this; and he conceived his proof to be good, when, by preffing the ribs of a fubject, he

* Mem. de l'Acad. Roy. 1781.

† Duverney.

‡ There is a diftinction in the movement of the dura mater to be obferved upon opening the fcull; one depending upon the pulfation of the arteries of the brain; the other caufed by an obftruction to the exit of blood from the cranium, depending upon the lungs. " On voyoit bien la pulfation des arteres du cerveau, qui " communiquoient quelque mouvement à la dure mere, mais ce mouve- " ment n'avoit ancune fymmetrie ayec celui de la refpiration. " Fatigué de ne rien voir après avoir fi bien vû je comprimai la poi- " trine de l'animal: auffitot le cerveau fi gonfla, evidemment par le " reflux du fang de la poitrine qui rempliffoit la jugulaire.—Je lachai " la poitrine, et le cerveau redefcendit."—Exper. 78. Mem. ii. par Haller fur le Mov. du Cerv.—" Il arrivoit pourtant de tems en tems et " fans que cela continuat que le cerveau fe foulevoit dans l'expira- " tion, et fe laiffoit repomper dans l'infpiration." Exper. 79. f. chat.

§ By Coiterus, Riolanus, Bartholin.

|| Diemerbroeck.

¶ M. Schlichting Mem. des Savans Etrangers, 1744. Lorry, Mem. prefent. a l'Acad. des Scien. par divers Savans Etrangers.

** M. de Lamure; vide l'Acad. de Sciences, 1744.

faw

ſaw the refluent blood ſwelling the jugular and abdominal cava. Haller obſerved the jugular veins ſwell, and become turgid, during expiration; and he concluded, that the motion of the brain was occaſioned by the refluent blood diſtending the ſinuſes of the brain. But he did not believe, as Lamure did, that this motion took place before the opening of the cranium, as well as after it.

When the ſcull is opened by a wound, the dura mater ſtill protects the brain, reſiſting inflammation, and giving the neceſſary and uniform ſupport to the more delicate ſubſtance and vaſcular membrane of the brain; but when the dura mater is lacerated by the trepan, or punctured, or worn by the pulſation againſt the edge of the bone, there may be ſudden hærnia of part of the brain from coughing, or a rapid and diſeaſed growth from the pia mater forming a fungus. Such fungus I once thought was, in ſome degree peculiar to children, but it is not; it is occaſioned, I conceive, by the taking away of that due compreſſion which the reſiſtance of the dura mater ought to give *.

OF THE TUNICA ARACHNOIDEA.

WHILE the dura mater is cloſely connected with the cranium, and in contact with the ſurface of the brain, but ſtill unconnected with it, (except by means of veins entering the ſinuſes and that only in the courſe of the ſinuſes) the pia mater is cloſely attached to the brain, and paſſes into its inmoſt receſſes. While the dura mater is firm and opaque, and not prone to inflammation, the pia mater is delicate, tranſparent, extremely vaſcular, and peculiar in being eaſily inflamed †. Like the dura mater, it is not endowed with ſenſibility ‡; it is of great ſtrength, conſidering its apparent delicacy §.

* I have ſeen in one day ſeven wounds of the head with fracture; of theſe, three had the bones thruſt through the dura mater. Theſe three died with fungus cerebri; the others did well.

† Mr. Hunter on the blood.

‡ Haller, Oper. Minor. de Part. Corpor. Humani ſent. & irrit.

§ Sir C. Wintringham Exper. Eſſays. Taken comparatively, it is ſtronger than the aorta.

The pia mater, which was formerly confidered as a fimple membrane, confifts, in reality, of two membranes, the tunica arachnoides, or meninx media, and the proper pia mater, or tunica vafculofa *.

The TUNICA ARACHNOIDEA was difcovered and commented upon by a fociety formed by Blafius, Sladus, Quina and Swamerdam †. They called it Arachnoides, becaufe of its extreme tenuity, comparing it to a fpider's web. It was called alfo Membrana Cellulofa, from the appearance it took when they infinuated a blow-pipe under it, and blew it up, feparating it from the pia mater ‡.

This membrane is without the pia mater; and while the pia mater finks down into the fulci of the brain, this covers the furface uniformly, without paffing into the interftices of the convolutions, or into the ventricles §.

This membrane is fo extremely thin, that it cannot by diffection be feparated for any confiderable fpace from the pia mater, and leaft of all, over the middle hemifphere of the brain. By the blow-pipe, indeed, we may raife it into cells, but it immediately fubfides again; on the pofterior part of the cerebellum, on the fpinal marrow and bafe of the brain, it is very eafily raifed and demonftrated ‖. It does not pafs deep into the fulci of the brain, but unites them by an extremely delicate cellular texture.

* There are many, however, who with Lieutaud confider the arachnoid coat as the external lamella of the pia mater.

† This was in 1665. I am, perhaps, not correct in faying they difcovered it; for Varolius defcribes it plainly, covering the medulla oblongata.

‡ Ruyfch. Tab. 10. Epift. Anat. Prob. viii.

§ Haller Elemen. Phyf. tom. iv. fec. viii. p. 7.

‖ F. Ruyfchii Refponfio ad A. os Goelecke Epiftol. ix. See Bidloo, table 10; but the membrane is fo delicate that it can be but very imperfectly reprefented by engraving. See alfo Sandifort Thefaur. vol. ii. p. 291.

OF

OF THE PROPER PIA MATER, OR TUNICA VASCULOSA.

THE pia mater is a ſimple membrane, without either tendinous, aponeurotic or muſcular fibres. It is extremely vaſcular, but it is tranſparent in the interſtices of its veſſels; it is the membrane which immediately inveſts and connects itſelf with the ſubſtance of the brain; and although delicate, it forms the ſupport and ſtrength of the cineritious and medullary ſubſtance. All veſſels diſtributed in the body, however minute, are always conveyed in membranes; the pia mater then follows, or rather conveys the veſſels not only into the cavities of the brain, but to every part of its ſubſtance, it being intimately blended with it *. We ſee it more diſtinctly deſcending in ſtrong plicæ into the interſtices of the convolutions; nor is it into them only that it enters, but into every pore which conveys a veſſel †. The pia mater as it paſſes into the ſubſtance of the brain, divides and ſubdivides into partitions and cells, and every capillary veſſel, and every molicule of the ſubſtance of the brain is inveſted and ſupported by its ſubdiviſions. The pia mater is to the brain what the cellular membrane is to the other viſcera and parts of the body; for it is the peculiar matter lying in the interſtitious cellular membrane (as in muſcles, bones, &c.) that gives the peculiarity of character to the parts ‡; the cellular membrane itſelf is nearly

* Columbus, the aſſiſtant of Veſalius, and afterwards profeſſor in Rome, explained this intimate intertexture of the pia mater with the proper ſubſtance of the brain, ſo far back as 1559.

† When we tear off the pia mater from the brain (for it cannot be called diſſection), it does not adhere merely at the ſulci, but to the whole ſurface of the convolutions; and every where ſmall veſſels enter, and with theſe veſſels deſcends alſo the lamina of the pia mater.

‡ "Sed cum continuo triduo in inquiſitione facienda perſeveraſ-"ſem: tandem deprehendi cerebri fibrillas eadem ratione, continu-"ataque ſerie, ſibi invicem annexas eſſe; quemadmodum fibrillas "carneas tendinibus adhærere demonſtravi; cum igitur illam cerebri "cum vaſis ſanguineis connexionem deprehendiſſem; et eam, quam "ante

nearly alike in all; therefore, in my judgment, the pia mater is rightly conſidered by ſome anatomiſts as a cellular ſubſtance *.

Malacarne ſays, I am much inclined to conſider it with the illuſtrious Haller as being compoſed of lamina, like common adipoſe membrane, and that the extreme arteries ramify through its cells, for, with a blow-pipe, we can raiſe it into cells like the common membrane; and if this be carefully done, the air may be made to paſs from cell to cell, following the arteries in their courſe betwixt the lobuli, and in the ſubſtance of the brain †. We can follow the mater into the ventricles, by tracing it betwixt the poſterior lobe of the cerebrum and the cerebellum, where it forms the velum interpoſitum of Haller, and paſſes under the fornix. We can follow it alſo into the poſterior horn of the lateral ventricles from the baſe of the brain, where the branches of the middle artery of the cerebrum paſs into the lower part of the choroid plexus; we trace it alſo into the bottom of the fourth ventricle. The pia mater lining the ventricles is more delicate, and leſs vaſcular than that ſeen upon the ſurface, and betwixt the convolutions of the brain.

It has been ſaid that the ventricles of the encephalon ſerved to increaſe the ſurface of the pia mater, and that whatever purpoſes are ſerved by that membrane and its veſſels on the ſurface of the brain, we muſt ſuppoſe the ſame performed by it within the ventricles ‡. This ſeems more like a ſatisfactory concluſion than it really is.

"ante dixi, variorum fructuum compagem attenderem; iterum con-"cluſi dominum, univerſi conditorem, in rerum creatarum fabrica "eaſdem vel conſimiles fere leges tenuiſſe."—"Igitur adverti fibril-"las certo loco ſibi conjunctas, mox alio loco ab invicem divertere, "paulo poſt iterum coëuntes." &c. Leeuwenhoek Epiſt. Phyſ. xxxiv.

* Bergen. Program. de pia matre. See Haller Anat.

† See Albinus Ann. Acad. Vol. i. lib. i. cap. xii. and the beautiful plate iii. See Ruyſch. tab. 8. Epiſt. Anat. vii. & tab. 15. Such is the profuſion of veſſels diſtributed to inconceivable minuteneſs, that it has been conſidered as entirely compoſed of veſſels; it has received the name of chorion, from the membrane of the ſecundines. Galen de Uſu Part. l. viii. cap. 8. Malacarne, Part i. ſec. 243.

‡ Dr. Monro's Nervous Syſtem, chap. vi.

As the tunica arachnoidea is of a peculiar nature, and has few if any veſſels, and as it covers the external ſurface of the brain only, it ſeems to me probable that this membrane is the cauſe why effuſions in the ventricles are ſo common, and why fluids are ſo ſeldom found betwixt the ſurface of the brain and the dura mater. When by the diſeaſed action of the veſſels of the pia mater on the ſurface of the brain an effuſion is thrown out, it very ſeldom lies unconfined upon the ſurface; but frequently fluids are contained in ſacs of the arachnoid coat, betwixt the convolutions of the brain, or raiſe pellucid veſicles upon the ſurface. The want of a tunica arachnoidea upon the pia mater of the ventricles, may be a cauſe of the fluids being ſo much more readily ſecreted into theſe cavities.

The raiſing of the archnoidea into veſicles by the action of the veſſels of the pia mater, is rather an argument for the diſtinct nature of theſe membranes. The tunica arachnoidea is raiſed by the action of the veſſels of the pia mater, as the cuticle is raiſed into bliſters by the inflammatory action of the veſſels of the cutis, while no other membranes of the body preſent ſuch an appearance in their diſeaſe. They inflame, indeed; they thicken; their lamina become more diſtinct, or their cellular ſubſtance fills with water, or hydatids are formed in them; but this appearance of water ſecreted under the tunica arachnoidea is quite peculiar.

1 Central Medullary Matter 2 Cineretious or Cortical Matter.

OF THE SUBSTANCE OF THE BRAIN.

THE cerebrum and cerebellum confift diftinctly of two very different fubftances; the cineritious and medullary matter, firft defcribed by Arch: Picolomini. The cineritious, or afh-coloured matter, forms the fuperficial or outer part of the encephalon, and is therefore called alfo the cortical part. This cortical matter is of a reddifh-grey colour and femitranfparent, but varies confiderably *; in the crura cerebri it is very dark; in the pons varolii it is redder; in the corpora olivaria † it is yellower. The confiftency of this matter alfo varies confiderably in different parts;

* Cuvier defcribes it black in fome places.

† Vicq d'Azyr.—" Exterior cerebri totius facies, donec in fpinalem medullam abeat, plerumque colore eft fubrubride cinereo, vel languide ruffeo. Fufciora funt cerebra fanguine ditia, *e. g.* hominum apoplexia enectorum, vel hominum craffioris fanguinis; pallidiffima vero funt cerebra hydropica vel hominum pituitoforum vel hæmorrhagia mortuorum. Dubio procul color cerebri fanguinis temperaturam feiqutur, et ideo pallidius eft infantibus, quam adultis." Sommerring Hum. Corp. Fab. vol. iv. p. 41. As Boerhave never

parts; it is soft in the base of the brain, betwixt the optic nerves and anterior commissure, and in the third ventricle. The medullary matter is chiefly in the internal part of the brain, forming a kind of nucleus or white central part; but in many parts of the brain, there is a mixture of these which form striæ *; and in some of the eminences, the internal part is cineritious, while the external part, or what we might here call the cortical part, is medullary.

The cortical or cineritious substance does not blend gradually with the white medullary matter, but on the contrary, their line of distinction is abrupt: an intervening substance has been observed. In inflammation of the brain, particularly, it has been said, that this third substance has been found. This may be merely the effect of light upon the union of the two substances. We, however, often observe an appearance of successive coloured circles upon the edge of the medullary matter of the arbor vitæ, in the cerebellum.

It has been asserted by M. Ludwig ‡, that the masses and striæ of the cineritious substance, dispersed through the internal parts of the brain, have a communication with each other. This, however, is denied by Vicq d'Azyr §. He conceives, that the cineritious substances of the pons varolii, or of the corpora olivaria, have no communication with the cineritious substance in any other part of the brain; and that in several parts of the brain the cineritious substance is surrounded and isolated by the medullary matter. Its great importance (which

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never saw, or observed, but merely imagined, he ought not to be regarded; now we may look for a better purpose into Albinus. Annot. Academ. vol. li. c. xii.

* Thus the cineritious substance is mixed with the medullary matter in the corpus callosum, in the corpora striata, the thalami nervorum opticorum, in the tubercula quadrigemina, the immenentia mamillaria; in the crura cerebri; in the pons varolii; in the corpora olivaria, and medulla spinalis.

† De Cinerea Cerebri Substantia. Lepsiæ.

‡ Hist. de l'Acad. Roy. an 1781. p. 507.

 should

ſhould never have been doubted) has been deduced from its being ſo generally found towards the origin of the nerves*.

The cineritious ſubſtance ſeems to have a much greater quantity of blood circulating in it than the medullary ſubſtance. Its veſſels come by two diſtinct routs, partly from the extremities of thoſe arteries which appear in large branches upon the ſurface of the brain, and partly by veſſels which penetrate through the medullary ſubſtance from the baſe of the brain. Ruyſch and Albinus have made the moſt minute injections of this part of the brain. The former conceived it to conſiſt entirely of veſſels; but Vicq d'Azyr and Albinus found always, in their experiments, that a great proportion of it remained colourleſs after the moſt minute injection. It is, indeed, very improbable, that ſo ſoft a body ſhould be enterely compoſed of veſſels. How, for example, can we ſuppoſe the commiſſura mollis, or cineritious matter, on the ſides and bottom of the third ventricle, or the almoſt tranſparent lamina, which we find in ſome parts, to be compoſed of veſſels †?

The white MEDULLARY SUBSTANCE appears to be a pulpy maſs. We obſerve no peculiarity of ſtructure in it towards the ſurface of the brain, where it is contiguous to the cortical matter; but towards the origin of the nerves it takes a more fibrous appearance. This appearance of fibres is not owing to any peculiarity in the me-

* Il faut que les uſages de la ſubſtance griſe ſoient tres-importans; car independamment de la portion de cette ſubſtance que les circonvolutions contiennent, et qui ſemble appartenir à la maſſe blanche du cerveau, ou en obſerve des amas plus ou moins conſiderables pres des diverſes origines des nerfs: ainſi pres de la premiere et la deuxieme paire, ſont les corps ſtries et les couches optiques; la troiſieme paire eſt pres d'un eſpece noiratre que je decrirai ailleurs; la quatrieme paire fort au deſſous des tubercules quadrijumcanx, dont le noyau eſt compoſé de ſubſtance griſe, la cinquieme, la ſixieme, la ſeptieme, ſe trouvent aux environs de la protuberance annulaire, ou la ſubſtance griſe eſt mêlée avec la blanche; la huitieme et la neuvième ſont placées près de l'eminence olivarie, où j'ai obſerve un mélange particulier de ſubſtance griſe. Mem. de l'Acad. Scien. an. 1781. p. 507.

† The medullary and cortical ſubſtance of white blooded animals preſent no difference of colour. *Cuvier.*

dullary

dullary matter, but to the manner in which the pia mater involves it. The medullary matter, being chiefly internal, has every where through the brain a communication from the fore to the back part, from the upper part to the baſe; from the great central part it extends in form of ſtriæ, into the corpora ſtriata and thalami; it inveſts the eminences in the lateral ventricles; and thoſe upper parts have communication with the medullary ſubſtance of the baſe.

M. Mickel found, upon comparing the brains of an European and of a negro, that the medullary matter differed very much in colour. In the negro, inſtead of the whiteneſs of the European, the medullary matter was of a yellow colour, and nearly like the cineritious matter: he obſerved alſo, that this very peculiar diſtinction of colour was only to be obſerved when the ſection was recently made, and that the darker colour of the medullary matter became fainter when expoſed to the air *.

OF THE OBSERVATIONS MADE UPON THE MINUTE STRUCTURE OF THE BRAIN.

THE opinions regarding the ſtructure of the brain have had a dependence on the general doctrines of the ſtructure of other ſecreting organs, and it is, of courſe, connected with the diſputations of Malpighi and Ruyſch, becauſe the doctrine of the glandular nature of the brain, and the belief of the nervous fluid, being a ſecretion,

* "La moelle du negre etoit d'un jaune clair, tirant un peu ſur le "gris, tandis que celle de l'Europeen etoit d'une parfaite blancheur." "Celui du negre etoit d'un jaune noiratre et celui de l'Europeen "d'une couleur blanche—Prolongeant enſui la diſſection juſqu' aux "grands ventricules du cerveau j'ai coupé horizontalement les corps "ſtries et les couches des nerfs optiques. C'eſt la où la difference a "paru vraiment etonnante, le corps ſtrie dans le negre etant preſque "de la couleur brune d'une ecorce d'arbre, au lieu que celui de "l'Europeen etoit couleur de chair pale tirant au cendre," &c.

tion, has, in all ages, formed the baſis of the moſt favourite theories *.

Malpighi found, on throwing in black and fluid injection, that there remained always particles colourleſs, and to which the injection did not penetrate. He conceived theſe to be glandular folicules, and that the cineritious ſubſtance of the brain conſiſted of this folicular or glandular ſtructure, while the medullary matter of the brain was merely the fibrillæ of the excretory duct. This opinion was founded on conjecture, with but a very poor ſhew of experiments, viz. by boiling the ſubſtance of the brain in oil, he found it take a granulated appearance, as if formed of ſmall grains, or little glands †.

Such was the received opinion until Ruyſch, with a deſpotical authority, ſwayed the opinions of phyſiologiſts: he alleged, in proof only his own experiments and preparations, in which other anatomiſts could not follow nor refute him, and therefore they acquieſced. His moſt unanſwerable and moſt inſulting argument was "veni et vide ‡."

According to Ruyſch, the cortical ſubſtance of the brain is entirely vaſcular, and has no appearance of a glandular or folicular ſtructure; nay, he conceived it to be entirely compoſed of arteries §. This opinion Albinus

* Indeed this doctrine of the glandular nature of the brain has deſcended from Hippocrates—"Caput quoque ipſum glandulas habet "cerebrum, enim eſt ut glandula album eſt et friabile," &c.

† "Pedamentum, ſupra quod poſita eſt philia in qua conſervatur "portio cerebri in liquore, quam decoxi in oleo olivarum per horas, "ſicuti, facere aſſolet Dr. Vieuſſens. Ea autem plane *mutilis et perverſa eſt preparatis*, nam nihilum quidem vaſculoſi viſui occurrit "poſt decoctionem in dicto oleo, et quod unuſquiſque tentare poteſt "ita ut inventor neutiquam habendus ſit Dr. Vieuſſens Sc. quod "cerebri cortex nil ſit, niſi extremitates vaſorum ſanguineorum: in ea "autem nemo hactenus (quod ſciam) me imitari poterit aut anologum quid fecit." Ruyſch Theſ. An. x. No. xxxii.

‡ "Milites quando hoſtium adventum audiunt, clament ad arma! "ad arma! ſic ego dico hic ad viſum! ad viſum!" Reſponſio ad J. Ch. Bohlium.

§ Vieuſſens was latterly of the ſame opinion, and is accuſed of plagiariſm by Ruyſch. Accordingly, we find, that in ſome parts of his works he deſcribes the glands and ducts of Malpighi.

confuted,

confuted, and Malacarne obſerves, though we ſuppoſe the extremities of the arteries of the cineritious ſubſtance to be more minute than thoſe which are diſtributed to the microſcopical corpuſculi of the ſmalleſt viſible inſect, there muſt ſtill remain ſome part, which is not compoſed of veſſels; and in regard to the veins of the cineritious ſubſtance we may appeal to Albinus, who, from the ſubſtance of the brain, finds many veins connected with the arteries of the cineritious ſubſtance when he carefully lifts the pia mater. But there is this peculiarity in the diſtribution of the blood veſſels of the brain, that, though the cineritious ſubſtance be the moſt vaſcular, yet, in the medullary matter, we ſee the veſſels with large open mouths, and more diſtinct than in the cineritious ſubſtance. In following the blood veſſels from the baſe of the brain into the medullary ſubſtance, we ſee them diſtinct, and of conſiderable magnitude; but when they are about to enter the cineritious ſubſtance, they diſperſe into minute branches *. In the ſame manner thoſe arteries, which are carried into the ſulci of the ſurface by the pia mater, branch into extreme minuteneſs before they finally penetrate the cineritious ſubſtance †.

Leeuwenhoeck ‡ obſerved, in the cortical ſubſtance of the brain, a pellucid, chriſtalline, and to appearance oily matter: he calls this, therefore, the *ſubſtantia pel-*

* Leeuwenhoeck ſaw, in the ſubſtance of the brain, but eſpecially in the cortical ſubſtance, red blood veſſels, but ſo delicate, that he could not comprehend how the globules of the red blood could paſs along them; and what appeared more particular, they were of a deeper colour than the red particles themſelves; for, when ſeen ſingly, they appeared to have very little colour. This he explained by an experiment made upon a louſe. After it had ſucked blood very plentifully, he obſerved, that the blood was broken down by digeſtion, and conveyed through the limbs and horns of the creature, ſo as to make it univerſally red. So here he conceives that the globules of the blood may be broken down and altered in their ſhape to enter the minute veſſels of the brain.

† Malacarne, Part II. ſect. 18.

‡ He was born in Delft in Holland, 1632, and died 1723. He is celebrated for his microſcopical diſcoveries; his papers are chiefly in the Tranſactions of the Royal Society of London, about the year 1674.

lucida et vitrea. When he had put a ſmall portion of this under his glaſs, he ſaw a fluid, which he at firſt conceived might have eſcaped from the globules that were neceſſarily cut by the knife. This fluid alſo he found to conſiſt of very minute globules, thirty-ſix times leſs than thoſe of the blood *. Theſe ſmall globules he conceived to have probably conſtituted a fluid, which, during the life of the animal, was moveable, and in veſſels, though now in death congealed and fixed †. The colour of the cortical ſubſtance he found to depend upon the minute ramification of the veſſels which were of a dark brown colour, while, in the medullary part, they were clearer and more tranſparent. Independently of this diſtinction of veſſels, he could obſerve little difference in the medullary and cineritious ſubſtance; the refraction of the rays of light amongſt the tranſparent globules being the cauſe of the whiteneſs of the former.

R. Della Torre ‡, in his microſcopical obſervations, deſcribes globuli in the brain; he ſays, that he ſaw them floating in a pellucid viſcous fluid. But Prochaſka || thinks Della Torre muſt be miſtaken in this, for when he took a ſmall portion of the brain, he ſaw it conſiſting of innumerable globules, which continued to adhere to each other, even after three months' maceration in water: and thence he concludes, that it could not be as R. Della Torre conceived, that theſe ſpherical bodies moved from the brain on towards the extremities of the nerves; nor do theſe bodies lie imbedded in a glutinous fluid (he continues) but they are connected by the extremely minute and pellucid ſepimentæ of the pia mater, and by the veſſels which pervade both the cortical and medullary matter, and which nouriſh as well as ſupport and connect theſe corpuſculi.

* Anatomica Contemplatio, 30. Ridley Anat. Cerebri, cap. xi.

† Among thoſe globules, of which the brain is compoſed, he ſaw alſo globules of the blood, which it was eaſy to diſtinguiſh by their roundneſs. Theſe red globules, he ſuppoſes, had eſcaped in conſequence of the minute veſſels having been cut by the knife.

‡ Nuove Oſervazioni Microſcopiche, Napoli, 1776.

|| Tract. Anatom. de Struct. Nervorum.

Fontana *, on submitting a portion of the medullary matter to the microscope, thought he discovered it to consist of small winding tubes filled with a transparent gelatinous humour. This he chose to call the intestinal substance of the brain.

Prochaska † cannot, from his own observations, determine whether the globular bodies of Della Torre be convoluted vessels, or what they are. R. Della Torre had observed, that they were largest in the cortical part, less in the medullary substance, still diminishing in the medulla oblongata, and least of all in the nerves; but succeeding observation did not support this assertion ‡. Malacarne expresses himself to be nearly of the same opinion in regard to the vesicular structure of the cortical substance of the brain. The minute processes of the pia mater, says he, embrace and support the medullary substance, which is surrounded with a matter of a darker colour, and less distinctly fibrous, but not less essential, and which is composed of corpuscules, that, in figure and arrangement, resemble the vesicles of the pulp of a lemon §.

Many authors endeavour to support their conjectures regarding this vesicular structure of the brain by morbid dissection ‖. We see the brain frequently degenerated into hydatids, or into little vessels, or into knobular glandular-like schirrosities. I have seen this vesicular appearance in great portions of the pia mater. I have seen the pia mater with innumerable little bodies like miliary glands upon it; and also the whole upper and external part of the brain degenerated into one mass of disease. It was hard, schirrous, tuberculated, and like

* Fontana's Treatise on Poison, and on the Primitive Structure of Animals, translated.

† Professor of Anatomy at Prague.

‡ This was certainly a theoretical deception: it is like the accurate observation of Fracassati, who could distinguish a difference of taste in the medullary and cineritious substance of the brain.

§ Malacarne, page 2. sect. 4.

‖ Wepfer de Cicuta Aquatica. Mangetus.—Malacarne, &c.

a diseased

a diſeaſed gland *. But I cannot conceive that any concluſion, in regard to the natural ſtructure of the brain, can be drawn from ſuch appearances. They are to be conſidered as the diſeaſes of the veſſels and membranes, rather than of the peculiar matter of the brain.

When the brain is examined in the fœtus of the early months, although the ſubſtance of the brain is extremely ſoft, and even of a fluid conſiſtence, the membranes and veſſels are fully formed, exquiſitely minute, and perfect in all their proceſſes, ſo that they give form and firmneſs to the brain. We ſee, conſequently, that the due increaſe and complete organization of the brain is a gradual proceſs, and like the growth of the other parts of the body.

OF THE SENSIBILITY OF THE SUBSTANCE OF THE BRAIN.

It cannot but appear ſtrange, that the very ſource or centre, to which every ſenſation is referred, ſhould itſelf be deſtitute of ſenſation; yet we are aſſured, by the experiments of Haller and Zinn, that the cortical ſubſtance of the brain has been irritated, without the animal being convulſed, or giving ſigns of pain † but when the medullary part of the brain is irritated, the effects are inſtantaneous, and the animal is convulſed. It has been obſerved, that as the injury of a nerve cauſes convulſions, ſo does that of the central parts of the brain, from which the nerves originate; but this ſenſibility

* There has been obſerved a ſtructure like the bronchial gland. Huber, Obſervationes Anatom.—Acta Helvetica, 1758. tom. iii.

† But, like the inſenſible membranes, it becomes irritable by diſeaſe; or by preſſure, which affects the univerſal function of the brain. Vander Linden, in his Medicina Phyſiologica (1613), brings proof of the inſenſibility of the brain. See the general enumeration of the effects of wounds in the brain. Haller Phyſiol. tom. iv. &c. Obſervations par M. de la Peyronnie de decouvrir la partie de cerveau ou l'ame exerce les functions.—Acad. Roy. des Sciences. Boerhaave, tom. ii.; with the Commentary of Haller, p. 595. for the effects of preſſure.

ſibility * diminiſhes towards the ſurface of the brain †. We ſee a diſtinction betwixt the ſtructure and function of the nerves and of the brain; or rather betwixt the cineritious ſubſtance of the brain and the nerves. For, although we muſt neceſſarily conclude, that the cineritious ſubſtance is an important, and, perhaps, the moſt eſſential part of the ſyſtem, ſtill it does not evince, by the immediate effect of injuries, that ſtrict ſympathy and univerſal connection which belong to the nerves.

The circumſtance has been thus explained. The nearer to its ſource that a nerve is pricked, the greater is the effect of the injury. As it recedes from the baſe towards the ſuperficies of the brain, the effect is leſſened, becauſe the connections of the part are diminiſhed in number, proportionally to their diſtance from the central parts of the brain; a puncture in the centre injures more filaments from their being concentrated to form nerves. This reaſoning is not ſatisfactory.

Several ounces of the brain have been loſt in conſequence of wounds, without death, or loſs of memory, or intellect ‡.

There is a very marked diſtinction betwixt puncturing, cutting, or even burning, the ſurface of the brain, and preſſing it. In the firſt there is little or no effect, or even pain. In the latter there is ſtupor, pain, or convulſions. The reaſon is, that in the firſt it is a local irritation in a place which has little, if any, feeling, while in the latter, the effect of the preſſure ſpreads extenſively.

No ſenſible man will expect, in the moſt minute and unwearied inveſtigation of the ſtructure of the brain, to find the explanation of its function. It is intereſting to find effects ſo peculiarly connected with the operations of the mind, depending upon a ſtructure of ſo groſs and

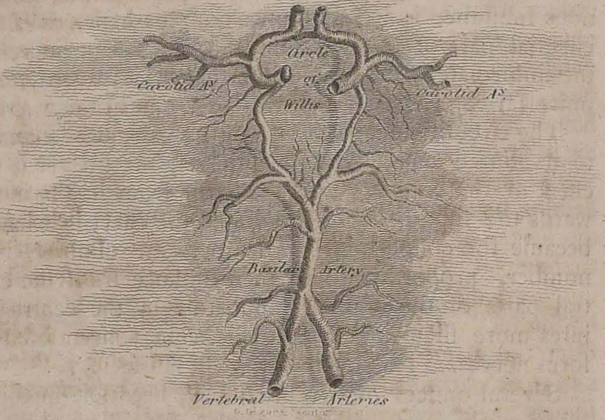
* It is in effect different from pain or ſenſation: it ſhakes the body with violent convulſions.

† Sommerring, tom. iv.

‡ M. de la Peyronie had a patient who loſt a very large ſpoonful of brain, but whoſe life and intellects remained.

animal

animal a nature as this of the brain, but ſtill, all explanation of thoſe operations muſt be viſionary.



CHAP. II.

OF THE VEINS AND SINUSES OF THE BRAIN.

THE brain is very profuſely ſupplied with blood, in ſo much, that the blood has been ſuppoſed to circulate in the brain in a proportion four times greater than in any other part of the body. This is the moſt moderate calculation, and it has been formed from a compariſon of the quantity of blood circulating in the head, with that which circulates in the arm. Boerhaave and Kiel, comparing the area of the arteries of the cerebrum with that of the aſcending aorta, made a moſt erroneous calculation of the proportion of blood circulating in the brain, compared with that of the reſt of the body. Had they compared the quantity of blood within the head with that of the lungs, of the liver, of the ſpleen, or of the kidney, the difference would have been leſs ſtriking.

Wherever

Wherever there is great arterial vaſcularity, we are ſure to find alſo peculiarities in the venous ſyſtem of the part; wherever we find an accumulation of tortuous arteries paſſing to a gland, we ſhall alſo find the veins tortuous and large; or wherever the arteries of a part take a diſeaſed action, the effect of this action will be found moſt perceptible in the change which the veins undergo. In ſhort, the effect of diſeaſe is much more ſurely to be diſcovered in the venous than in the arterial ſyſtem; and no where is this better exemplified than in the brain.

The following appear on the firſt view to be the moſt ſtriking peculiarities in the veins of the brain; their ſize; the little connection they ſeem to have with the ſurrounding cellular membrane, and the inconſiderable ſupport which they appear to receive from it; their having no valves; their being in their courſe diſtinct from the arteries; and laſtly, their not being gathered into great trunks, but emptying themſelves into the ſinuſes of the dura mater.

It is not eaſy to conceive how the veins of the brain ſhould have been ſo much overlooked by the older anatomiſts; but from the diſſections of Albinus, and the microſcopical obſervations of Leeuwenhoek, we have authority for what is, perhaps, in itſelf ſufficiently evident, that the veins of the ſurface of the brain are derived from minute ramifications conveyed in the delicate pia mater; and that theſe, as in the other parts of the body, proceed from the extremities of the arteries, without any apparent peculiarity in the connection betwixt the extremities of the arteries and the veins of the brain *.

* The obſervation is trivial; but we muſt recollect, that Veſalius contradicted Galen, and affirmed, that the ſinuſes received alſo arteries which gave them their pulſation. This opinion was refuted by Fallopius, but adopted by Vieuſſens, Wepfer, and others, upon the idea of the facility with which injection paſſes from the arteries into the ſinuſes. See Ridley, cap. vi. de Cerebri Motu, ejuſque Sinubus.

The

The deſcription of the veins of the brain, previous to their entering the ſinus, has been neglected. I divide them into the external and internal veins of the brain, or thoſe which emerge from its ſubſtance, and are ſeen upon the ſurface; and thoſe which, coming chiefly from the ſides of the ventricles, are convoluted in the plexus choroides, and terminate in the fourth ſinus.

OF THE VEINS WHICH ARE SEEN UPON THE SURFACE OF THE BRAIN.

Vicq d'Azyr has been minute in his attention to the veins of the ſurface of the brain. He confirmed the obſervation, that almoſt all the veins which paſs into the longitudinal ſinus, open in a direction contrary to the ſtream of blood in the ſinus *. Theſe ſuperficial veins of the ſurface of the hemiſpheres, are in number generally from ten to fifteen on each ſide. They really do not ſeem to be worthy of the minute attention which Vicq d'Azyr has beſtowed upon them; he has moſt carefully deſcribed each individual branch, and that not in general terms, but firſt thoſe of the right, and then thoſe of the left ſide. Now, although theſe veins do not enter the ſinus oppoſed to each other, nor in pairs, ſtill the irregularity is trifling, and were it important, does not admit of deſcription. Thoſe veins do not lie in the

* From Vicq. d'Azyr's table we ſhould be led to conclude, that the veins did not decidedly all open with their mouths oppoſed to the ſtream of blood. Ridley aſſerts, that one half open backwards. Santorini alſo obſerves great variation in the direction of theſe veins. Lower, while he obſerved this direction backwards, deſcribes them, at the ſame time, as paſſing obliquely betwixt the coats, like the gall duct in the inteſtine, or the ureters into the bladder. Sabbatier ſays decidedly, that they enter with their mouths oppoſed to the courſe of the blood in the ſinus. From Malacarne, we ſhould be led to conceive (what I believe to be the truth, that they open very irregularly. " Non tutte queſte vene ſboccano obliquamente ad un " modo nel ſeno, come non a tutte la membrana interna del mede- " ſimo ſomminiſtra quella valvuletta, che pure a mo' di lingua, di " briglia, di mezza luna frequentemente ne ottura la meta, il terzo, " o minor parte degli orifici." Malacarne, p. 94.

ſulci of the brain, but paſs occaſionally along the interſtices, or over the convolutions of the brain; they take in general a courſe from before backwards, but previous to their entering the ſinus, are turned forwards. We have already obſerved, that the pia mater and dura mater have no connection, but at the place where thoſe veins enter the lamina of the dura mater; and here their connection is ſomewhat peculiar. It is not a ſimple adheſion of the pia mater and dura mater; but a white ſpongy ſubſtance ſeems to connect and ſtrengthen them, and, when torn aſunder, it leaves a ſoft fatty kind of roughneſs upon the pia mater. Theſe appear to me to be the ſame bodies which Ruyſch ſo frequently mentions as little particles of fat, and which others have taken to be the glands of the pia mater *. Vicq d'Azyr, in his xxxiiid plate, fig. 14. has confounded them under the name of the glandulæ Pacchioni †. Of theſe veins lying upon the ſurface of the brain, there is one, or very often there are two large veins on each ſide, and which enter generally pretty far back in the ſinus, and are ſomewhat peculiar from their greater ſize, and their ſemicircular courſe. Theſe, from their ſtate of dilatation, and the colour and fluidity of their blood, will be found in morbid diſſection, to mark ſufficiently, in many inſtances, the character of the venous ſyſtem of the brain. There is again another vein ſomewhat peculiar in its courſe: whilſt thoſe take a ſuperficial courſe, and are

* "Portio piæ matris in liquore, cujus ſuperficies exterior obſita "variis particulis prominentibus exiguis, quas pro glandulis habuerunt nonnulli: cum autem ſint diverſæ formæ, et colore pinguidinem repræſentent, pro pinguidine potius illas habeo, præſertim "cum inter duplicaturam piæ matris aliquoties pinguidinem invenerim." Theſaurus Anat. ix. N°. xlii. Epiſt. ix. p. 8. Theſ. v. N°. 1.

† We ſee alſo what he ſays in the Acad. of Sciences, An. 1781, p. 502. "Elles étoient plus ou moins recouvertes, vers leur inſertion par les glandules de Pacchioni: les ayant examinés dans pluſieurs ſujets, j'ai obſervé qu'elles étoient a peu-pres, de chaque "côté au nombre de dix, douze, ou quinze." Ridley calls theſe "carnous adneſcences," betwixt the membranes, p. 8. As to the gland which Willis affirms to be ſcattered over the tunica arachnoides, I could never ſee them. Ridley.

upon

upon the level of the longitudinal ſinus, it gathers its branches upon the internal flat ſurface of the left hemiſphere, and riſes ſo as to inſinuate itſelf into the inferior part of the ſinus *. All theſe veins of the ſurface of the cerebrum have very free inoſculations with each other.

I cannot any where better obſerve the negligence of authors, in regard to the glandulæ Pacchioni, than when ſpeaking of the mouths of thoſe veins which open into the great longitudinal ſinus.

I cannot help thinking, that many of our beſt authors have overlooked entirely the importance of the glandulæ Pacchioni; and many alſo have been entirely ignorant of them. We have already mentioned, that a few ſmall bodies, by no means conſtant nor regular, were to be ſeen upon the external ſurface of the dura mater, in the courſe of the longitudinal ſinus, or at no great diſtance from it. We have mentioned alſo thoſe fatty-like adheſions of the roots of the veins, as they enter the ſinus, and which rather belong to the pia mater. Both theſe are called the glandulæ Pacchioni improperly. The bodies which engaged Pacchioni and Fautonus in ſuch violent diſputes, are ſeen on the inſide of the longitudinal ſinus, and are connected with the opening of the veins †;

* Vicq d'Azyr.

† "In longitudinali ſinu, immediate, ſub membranoſis expanſionibus, in areolis chordarum Williſianarum, quin et ſupra eaſdem chordas conſitæ ſunt innumeræ glandulæ conglobatæ, propria, et tenuiſſima membrana, veluti in ſacculo concluſæ; quæ racematim ut plurimum coeunt; raro ſparſim diſponuntur: hæ glandulæ utrinque ad latera falcis meſſoriæ, ab ejuſdem apice ad baſis uſque poſticam partem miro prope modum artificio procedentes, dorſo lacertorum accumbunt, & partim ab horum fibris, partim ab iis, quæ a chordis emergunt, firmantur, atque invicem alligantur, ita ut non niſi lacerat acu disjungi poſſint." Vide Pacchioni, p. 126.

"Sinu longitudinali aperto, in conſpectum veniunt corpuſcula rotunda, & ſubrotunda, milii forma, (a clariſſ. viro Pacchiono detecta) hæc magnitudinem aciculæ vulgaris caput haud ſuperant, niſi per microſcopium introſpiciantur, aut ex duobus corpuſculis combinentur." Ruyſch, Theſ. vii. N° xxxiv. From this we ſee how various the ſize of theſe bodies is. In the next paragraph he obſerves, "Vix et ne vix quidem ullum ex dictis corpuſculis videre poteſt."

they

Longitudinal Sinus laid open & the Glandula Pacchioni seen

An Accurate Copy of Pacchioni's Plate of the Glands.

Engrav'd by Fran. Lamb.

they appear of a fleshy colour, projecting like papillæ, or like the granulations of a sore. Pacchioni says, " Ovorum instar bombycinorum apparent," which describes their conglobate appearance; but they are of a pale fleshy colour, which Pacchioni says is owing to their being surrounded with muscular fibres. I have added the plate of Pacchioni, and contrasted it with a more natural drawing of them. The preparation from which Pacchioni had taken his plate, was previously macerated in vinegar. These bodies being soft and vascular, have allowed the minute injection to transude in some of the experiments of anatomists, which has given rise to the opinion of the actual communication of the arteries of the dura mater with the sinuses. As to their use *, I am in considerable doubt. Joan. Fautonus (in his letters to Pacchioni) conceives that they give out a fluid into the sinus, to dilute the venous blood †. Pacchioni describes ducts passing from them to the pia mater, (which are those connections that we have already remarked,) and conceives that they lubricate the surface, or communicate with the substance of the brain; and that they are pressed, and their secretion promoted by the motion of the chordæ Willisianæ, and the action of the dura mater ‡.

I should rather conceive that they had a valvular action on the mouths of the veins; they project from the mouths of the veins into the sinus, and the blood passing from the veins must filter through them, and be checked in its retrograde course, and perhaps ob-

* It is curious that these bodies are confined to the longitudinal sinus. " Mirum, & æque animadversione dignum est, hasce glan- " dulas ad solius longitudinalis sinus latera reperiri cum in lateralibus " sinibus vel nunquam, vel raro admodum per pauca earundem " vestigia adnotentur, ubi præsertim præfati canales deorsum incli- " nare incipiunt, antequam ab intersepto rum dorso discedant." Pacchioni, p. 127.

† " Ego aqueum humorem in glandulis egregari, fluere lympham " in tubulis, quos tecum lymphaticos appello, nunquam negaverim, " sed liquidi fluxum ab utrisque versus sinum magis, quam versus am- " bitum cerebri verisimilem, magisque naturæ legibus consonum esse " affirmo. Fautonus Epist. D. A. Pacch. Oper. Pacch. 177."

‡ " Ex iis autem in minimum quidem vasculum lymphaticum pro- " dire conspicere potui." Ruysch.

 structed

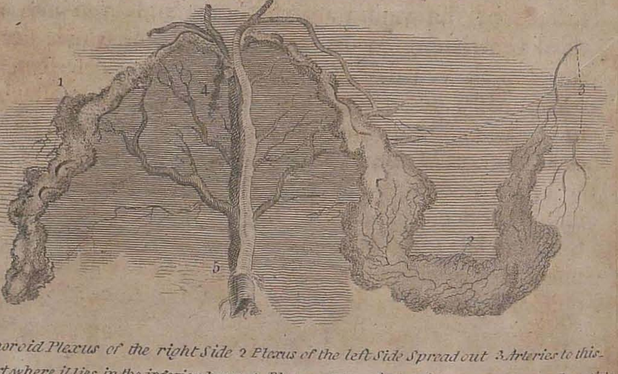
ſtructed in its natural courſe when they are enlarged. As theſe bodies differ very much in the variety of ſubjects, they muſt ſometimes impede the free egreſs of the blood from the veins of the cerebrum into the longitudinal ſinus, and cauſe diſeaſe, eſpecially as they are ſofter and larger in old men*. At all events, they are too much overlooked in morbid diſſection.

The veins which anſwer to the arteria corporis calloſi, and which are ſeen lying upon the corpus calloſum in a very fine cellular membrane, riſe and paſs into the inferior longitudinal ſinus, that which is formed in the lamina of the inferior edge of the falx.

OF THE INTERNAL VEINS OF THE BRAIN AND OF THE CHOROID PLEXUS.

UNDER this title of the internal veins of the brain, the choroid plexus comes naturally to be conſidered.

the Choroid Plexus & Vena Galeni taken from the Brain & Spread so as to Show their Connection



1 *Choroid Plexus of the right Side* 2 *Plexus of the left Side Spread out* 3 *Arteries to this part, where it lies in the inferior horn* 4 *Plexus of the 3.d Ventricle formed by the Junction of 1, 2.* 5 *Vena Galeni*

D. Lizars, Sculp.

* Fibris carneis tenuiſſimis circumambiuntur ſingulæ, unde co-
" lorem carneo-pallidum nanciſci videntur: in ſenibus vero, in qui-
" bus hujuſmodi fibræ enervatæ nimis laxantur, et ferme diſparent,
" glandulæ albeſcentes, & magis turgidæ cernuntur: quod, & in
" hydrocephalicis, comatoſis, & id genus aliis obſervari poſſe arbi-
" trarer." Pacchioni Oper. p. 126, 127.

The

The moſt remarkable thing in the ventricles of the brain is, that they have lying in them this very peculiar vaſcular ſtructure, the choroid plexus. The lining membrane of theſe cavities is extremely thin and ſmooth, inſomuch, that ſome anatomiſts have denied its exiſtence; but through the whole ventricle there run certain folds or plaits of this membrane, which are ſo loaded with veſſels as to reſemble a fleſhy ſubſtance, and to loſe altogether their reſemblance of the lining membrane. The plaits, before they are unravelled, look like maſſes of tortuous veſſels, lying looſe and unconnected in the bottom of the ventricles.

The largeſt portion of each choroid plexus comes up from the inferior horn of the lateral ventricles; they then run forwards. In each ventricle they lie in the groove, betwixt the thalamus nervi optici and corpus ſtriatum: and cover the tenia ſemicircularis geminum. The two plexus of the lateral ventricles unite under the anterior crus of the fornix, and form a ſmall plexus, which is continued upon the inferior ſurface of the velum interpoſitum, and even into the third ventricle. Again, there is a plexus which lies in the fourth ventricle. Vicq d'Azyr alſo deſcribes, as occaſionally occurring, little inſulated plexus attached to the veins, branching on the corpora ſtriata *. Thus each diviſion of the brain has its choroid plexus.

Theſe vaſcular webs muſt have an important uſe. I ſhould conceive that they chiefly ſecreted the fluids of the ventricle; for I believe the tortuoſity to be the moſt unequivocal mark of the activity of veſſels. This opinion, however, is nothing new †. Another prevailing

* " Sur le côte des ventricules latéraux, j'ai quelquefois obſervé " de petits plexus choroides iſolés, que accompagnoient quelquefois " de ces rameaux des veins de Galien, que l'on voit paſſer ſous le " tænia ſemicircularis, & s'etendra ſur le corps ſtrie." Vicq d'Azyr. Memoir. l'Acad. Roy. 1781, p. 540.

† The ſuppoſed glands of the plexus choroides were conceived to ſecrete the fluid of the ventricles. Where the plexus lies upon the poſterior crura of the fornix, it is often diſeaſed, having knots like glands, or, being raiſed into veſicles, like hydatids. " Eas bullas " humorem

ing idea was, that the blood accumulated in theſe convoluted veſſels, occaſioned ſuch a gentle continued heat as favoured the circulation of the ſpirits through the cavities of the brain, and preſerved the fluidity of the water of the ventricle *. Great variety of opinions have prevailed regarding the ſtructure of thoſe bodies. We ſee them conſiſting of knots of convoluted veſſels ; chiefly veins ; or theſe at leaſt are moſt evident from their ſize, and the colour of their blood. Theſe convolutions of veſſels are by many good anatomiſts deſcribed as glands. Varolius, Sylvius, Wharthon, Willis, Santorini, and Lieutaud, conſider them as ſuch †. Three ſets of ARTERIES paſs up to the PLEXUS CHOROIDES, from the baſe betwixt the crura of the brain ; they come, 1ſt, from the curve of the internal carotid artery ; 2d, from the communication betwixt the baſilar and carotid artery ; 3d, from the baſilar artery, and moſt poſterior part of the branch of communication. Theſe arteries, which are ſmall, are convoluted into great minuteneſs ‡

" humorem ventriculorum ſecernere olim conjectura fuit. Verum " vitio cum naſcantur vix perpetuum habitum generare idoneæ erunt." Haller, tom. iv. 48.

* See Duverney, tom. i. p. 55. " Ut enim ſanguis intra ſinuum " cavitates aggeſtus, Balnei calidioris vicem preſtat, quo ſpiritus " animales in extima et corticali cerebri parte uberius diſtillentur: " ita ſanguis intra plexus hujus vaſa exilia contentus, quo iidem ſpiri- " tus in penitiori ac medullari ſubſtantia idonei circulentur, Balnei " minoris, & magis temperati loco eſſe videtur." Willis Cerebri Anat. p. 47.

† Galen gives a good deſcription of the choroid plexus ; he deſcribes the innumerable veins of which it is compoſed, and their joining the fourth ſinus by the vein which retains his name. Some have confuſed themſelves with a paſſage of Ruyſch. Theſ. iii. No. lxv, &c. in which he is ſpeaking of the choroid plexus, where it appears in the baſe of the ſcull, from the bottom of the fourth ventricle. They have underſtood him to ſay, that the plexus was covered, not with the pia mater, but with the tunica arachnoides, firſt deſcribed by Morgagni, and whoſe authority we may conſult for much of this part of anatomy. Adverſar. Anat. vi. Animad. 1. & ſequent.

‡ " Huncce plexum nil eſſe niſi arteriolas, ad viſum ſuccoſas, a " naturali conſtitutione arterioſa non nihil recedentes, mirumque in " modum contortas, ſerpentinoque modo reptantes, glandulaſque " repreſentantes." Ruyſch, Theſ. v. Aſſer. quartus, N° lxviii. Not. 2.

in

in the membrane, and their blood is returned by veins, which taking a very tortuous courſe, ſeem to entangle their branches, and form a meſh of veins.

The blood of the two plexus of the lateral ventricles, and that of the third, is conveyed into the velum interpoſitum, or that membrane which ſtretches under the fornix, and over the third ventricle. The branches of veins alſo which extend themſelves upon the ſides of the lateral ventricles, and into the proceſſus digitalis, being gathered together upon this membrane, open into the vena galeni; or rather form it.

The moſt remarkable branches of veins in the lateral ventricle are theſe: A conſiderable branch is ſeen to collect its branches upon the anterior part of the ventricle, and in the anterior ſinus, or horn of the ventricle. This vein runs back towards the anterior crus of the fornix, and dips under it, juſt above the communication of the ventricles; and joins the veins in the velum of Haller. Other ſmall veins are ſeen collecting their branches upon the corpora ſtriata; and, paſſing under the centrum ſemi-circulare geminum, connect themſelves with the plexus. Again ſeveral branches of veins are extended in the poſterior part of the ventricle. Theſe are from the medullary ſubſtance of the poſterior lobe of the cerebrum. They paſs under the poſterior crus of the fornix and join the vena galeni. Laſtly a vein remarkably tortuous, frequently full of blood, paſſes forward and is ſeen at intervals in the plexus choroides. This vein taking an acute turn, joins its fellow under the anterior crura of the fornix and is reflected backwards and under the fornix, ſo as to form the beginning of the vena galeni.

The VENA GALENI then is the great central vein of the brain. It ſtretches from the extremity of the fourth ſinus into the internal part of the brain, to receive the blood from the membrane lining the ventricles,—from the ſubſtance of the brain,—from the plexus choroides,—and from the velum interpoſitum *. It lies under the

* The velum lying upon the nates and teſtes, and adhering to them and the pineal gland, the vena galeni receives here alſo veins from thoſe bodies, and from the upper part of the cerebellum.

posterior part of the corpus callosum, under the fornix and above the nates and testes. It is entangled in the velum itself. It consists of two great branches which lie parallel to each other, and which sometimes have the appearance of being twisted, and these unite before they enter the fourth or straight sinus.

In the BASIS of the BRAIN the veins are not remarkable nor do they require any description distinct from the sinuses into which they open.

They are small, having little way to run; and before they become large trunks, they empty themselves into the numerous lesser sinuses betwixt the dura mater and base of the scull. This is perhaps a provision against the pressure of the brain. In passing into those sinuses, the veins take a long oblique course betwixt the lamellæ of the dura mater; which has given occasion to anatomists to describe many intricate lesser sinuses.

OF THE PARTICULAR SINUSES.

By the term sinus we are to understand the great veins of the brain, where they are received into the triangular canals of the dura mater.

SUPERIOR LONGITUDINAL SINUS.

THIS is a triangular channel, running in the falx from the crista galli of the æthmoid bone to the crucial ridge of the occipital bone. It is not constant in its origin. Sometimes it begins from a blind foramen before the crista gilla *. Sometimes from the orbital sinus †. In some subjects it begins only opposite to the fontanelle, or even further back, and then at once swells out to a large size.

* Malacarne, Haller, Gautier.

† These sinuses as frequently are continued into the inferior longitudinal sinus or into the circular or elliptical sinus; they are like azure streaks under the dura mater, covering the orbital process.

As the ſinus paſſes backwards it is gradually enlarging for the reception of the veins from the ſurface of the cerebrum. As we have already demonſtrated by the marginal plate of the ſection of the longitudinal ſinus (page 368), the baſe of the angle is curved, anſwering to a ſulcus, which runs in all the length of the cranium, from the æthmoid bone to the crucial ridge of the occipital bone. The lateral planes are drawn tenſe and converge into an acute point; the angle formed by the ſplitting of the internal layers of the dura mater, is ſtrengthened by ſtrong ſlips of fibres, which upon the inſide of the ſinus have the effect of making it irregular, and in ſome degree having the appearance of cells, into ſome of which cells the probe enters, and leads to the veins on the ſurface of the brain; others are blind, or lead to leſſer ſinuſes, which not unfrequently run parallel for ſome length to the great ſinus; or the probe paſſes from one of theſe cells to another. Sometimes, however, the ſinus has no ſuch irregularities, but is ſtraight and ſmooth through its whole length *.

This ſinus has in ſome rare inſtances been found of a ſquare ſhape; its lower ſurface ſerving as a roof for another ſinus of a triangular form, which, for ſome way, ran parallel with the great ſinus, and which was of courſe alſo included in the lamina of the falx—theſe Malacarne calls ſeni ſubalterni. Irregular leſſer ſinuſes are by no means uncommon, and they form, ſometimes, communications through a great extent of the longitudinal ſinus; or again it will be found that the longitudinal ſinus deviates conſiderably, in ſome ſubjects, from the ſtraight line, taking a curve or circle, generally behind the fontanelle; or it ſends off branches, which again unite with it; or it is fairly divided. In all theſe caſes the chords or faſciculi of the dura mater ſtretch out over the ſinuſes, and protect them from compreſſion.

* The internal membrane of the ſinus is perfectly ſmooth, and is continued into the coats of the internal jugular veins; it is of the ſame nature with the internal coat of the vein.

 Inſtead

Inftead of reaching backwards to the crucial line upon the occipital bone, the longitudinal finus has been found to divide at the beginning of the lambdoidal future, and to follow them in a direction towards the petrous bone *, while the lateral finufes, running in the duplicature of the tentorium, were reduced to a very narrow compafs.

From the ftrength of the connections of the finufes, and from the languid courfe of the blood through them, I fcarcely believe that the finus has ever fuffered the diftention, which Malacarne defcribes in fome cafes. I fhould rather fuppofe that what he mentions had been natural and congenital enlargements; efpecially confidering that the finufes, like the other veins of the body, are very apt to be irregular.

LATERAL SINUSES, OR THE FIRST AND SECOND OF THE ANCIENTS.

The lateral finufes are formed by the fplitting of the lamina of the tentorium, as the longitudinal finus is by that of the falx. From the crucial ridge of the occipital bone they ftretch nearly horizontally; following the connections of the tentorium in a direction toward the petrous bone; then they take a curve downwards and forwards, to terminate in the internal jugular vein; paffing through the foramen lacerum betwixt the temporal and occipital bones.

Very frequently the one lateral finus is larger than the other—generally the right is the larger, and fometimes the left is entirely wanting †.

They diverge from the termination of the fuperior longitudinal finus at the crucial point of the occipital bone: but fometimes they are irregular, diverging higher, and even paffing round in the circle of the pofterior part of the cranium, at fome diftance from the tentorium ‡.

* Malacarne, part i. 148. † Lieutaud, Anat. Hift.
‡ Malacarne.

The

The right lateral ſinus for the moſt part begins higher than the left. It is generally longer, and may be conſidered as the continuation of the longitudinal ſinus. Nay, in ſome ſubjects, the right or left lateral ſinus begin from the longitudinal one, while that of the other ſide is continued from the fourth, or the torcular hierophili; and the lateral ſinuſes are ſeparated at their origin by a membranous iſthmus—if it ſhould happen that the left lateral ſinus receives the ſuperior longitudinal one, it would be found to be four times the ſize of the right; ſometimes, alſo, the longitudinal ſinus, turning to the right, is continued into the ſinus of that ſide; and the left lateral ſinus opens or begins by two or more irregular holes *.

I have ſeen a more remarkable variety of the lateral ſinuſes. The blood which ſhould flow from all thoſe parts of the brain from which the ſuperior and inferior longitudinal ſinus, and the vena Galeni, and fourth ſinus are derived, ſeemed, inſtead of paſſing by the root of the tentorium, to have forſaken theſe channels; the lateral ſinuſes were left diminutive; and the blood had taken a courſe in the tract of the poſterior occipital ſinuſes, and, after incircling the foramen magnum, it gained its uſual outlet †.

The angles of the lateral ſinuſes are ſtrengthened by membranous faſciculi; betwixt theſe the veins enter as in the longitudinal ſinus; where the ſinus deſcends from the level of the tentorium in the angle formed by the occipital and petrous bones, there are many ſtrong irregular faſciculi of fibres: under this point, being no longer protected from compreſſion, by their triangular ſhape and the tenſion of the tentorium, the ſinuſes are irregular; they are now ſunk in the ſulci of the bones, and the dura mater ſpreads its ſheath over them.

* See Morgagni Adverſaria VI. tab. i. fig. 1.

† There are inſtances of the lateral ſinuſes opening into the external jugular vein.

The

The great irregular cavity*, in which the extremities of the lateral ſinuſes lie †, and the foramen lacerum have much variety, and their ſtraightneſs ſeems to affect the ſize of the ſinus in its whole length ‡.

OF THE INFERIOR LONGITUDINAL SINUS.

THE inferior longitudinal ſinus, or the leſſer, or inferior ſinus of the falx, runs in that edge of the falx which penetrates betwixt the hemiſpheres of the cerebrum. It is extremely ſmall towards the fore-part of the falx; but, as it paſſes backwards, it goes on increaſing by the acceſſion of veins which come from the hemiſpheres, and corpus calloſum, and from the falx itſelf. It is formed betwixt the lamina of the falx. Sometimes it runs in its very edge, but as frequently a little way removed from it; ſometimes it is found beginning very far back in the falx. The fore-part of it is more like a vein running in the falx than a ſinus. It is in general to be ſeen more ſuperficial, and in every reſpect like a vein, (there being no proviſion for preſerving it from compreſſion,) upon one ſide of the falx. It very often takes a waving courſe upon the falx; while it receives veins, which branch in the ſubſtance of the falx, and form communications betwixt it and the ſuperior longitudinal ſinus. It opens into the ſtraight or internal ſinus, near the edge of the tentorium.

* Lower conceives that the ſize of the jugular foſſa was the effect of the reflux of the blood; and that the greater ſize of the ſinus of the right ſide was to be traced to the practice of nurſes laying their children chiefly on the right ſide! See alſo Morgagni Adverſaria Anat.

† See Willis Anatom. Cereb. Hum. p. 29, and the plate.

‡ Some very large veins open into the lateral ſinus; they are derived from the poſterior lobes of the cerebrum and the cerebellum. Theſe inſinuating irregularly betwixt the lamina of the tentorium, and running for ſome way, have been conſidered as additional ſinuſes. See Haller, tom. iv. p. 149.

OF

OF THE INTERNAL, STRAIGHT, OR FOURTH SINUS *.

I WOULD call this the internal ſinus, from its ſituation, but more particularly from its receiving the veins from the internal part of the brain. This ſinus is formed chiefly by the vena galeni; which, coming out from betwixt the corpus calloſum and tubercula quadrigemina, enters betwixt the lamina of the middle part of the tentorium, where it is united to the falx; ſo that by the tenſion of theſe two partitions this ſinus is drawn into a triangular form, and is as incompreſſible as thoſe ſinuſes which run connected with the bone.

It opens, for the moſt part, by an oval mouth, formed by ſtrong pillars of fibres, into the left lateral ſinus, rather than directly in the middle of the communication of the three great ſinuſes. We ſhall find this like the other ſinuſes ſuffering conſiderable variety; or irregular ſmaller ſinuſes will often be found running betwixt the lamina of the tentorium.

POSTERIOR OCCIPITAL SINUSES.

THESE are ſo called in oppoſition to ſome irregular and ſmall ſinuſes, which run upon the occipital bone before the great foramen. THE POSTERIOR OCCIPITAL SINUS lies in the little falx of the cerebellum; it riſes upwards, and opens into the common union of the longitudinal and lateral ſinuſes; it commonly, however, lies rather to the left, and empties itſelf into the left lateral ſinus. It is by no means † conſtant; like the other leſſer ſinuſes it is ſubject to great variety; and, before it riſes into the tentorium, or empties itſelf into the larger ſinuſes, it has a communication or emiſſarium, by

* Sinus quartus, Perpendicularis. Haller—The fourth ſinus; the two lateral being the firſt and ſecond, and the longitudinal being the third ſinus.

† Vicq d'Azyr.

which

which part of the blood may paſs into the external veins, through a foramen in the centre of the occipital bone *.

THE INFERIOR LATERAL SINUSES.

THE inferior lateral ſinuſes are ſtill more rarely to be found than the laſt, in ſo much that Vicq d'Azyr ſays he never has ſeen them. They run in the lamina, or under the dura mater of the poſterior foſſa of the baſe of the ſcull; that is the hollow of the occipital bone, which is under the tentorium. They are ſo irregular that they frequently occur in one ſide only. They communicate with the poſterior part of the foramen lacerum; with the poſterior petrous ſinus or vertebral veins; or laſtly they occur as an irregular collection of channels running in the ſeveral neighbouring ſinuoſities †.

We ſee then that there is a point of union for all theſe ſinuſes, which we have not as yet deſcribed: we ſee that the ſuperior longitudinal ſinus, the two lateral ſinuſes, the fourth (and conſequently the inferior longitudinal ſinus), and the poſterior occipital ſinus, unite at the crucial ſpine of the occipital bone. This is the torcular hierophili ‡, torcular, lacuna, platea, tertia vena, palmentum, pelvis, laguncula. It was natural that the attention of the ancients ſhould be drawn to this part; for, upon opening this union of the ſinuſes, we find a large

* Malacarne.—This ſinus is ſometimes double; or it has two branches encircling the poſterior margin of the occipital hole; or, as I have already obſerved, it takes the office of the great ſuperior lateral ſinuſes, and empties it into the foramina lacera; or they communicate with the vertebral veins. See Obſervations ſur un dilatation ſingulière des ſinus occipitaux, Mem. de l'Acad. Roy. Anno 1781, p. 596.

† "Independente dai ſeni lateralia inferiori ho veduta tra le robuſte "lamine e le fibre, dalle quali incomincia craſſiſſimo l'imbuto verte"brale intorno al maggior foro del cranio una quantita di caverne, di "cellule communicanti inſieme, le quali formavano un ſeno circolare "irregolariſſimo appoggiato ſulla parte ſuperiore, o ſia ſul margine "interno del foro medeſimo." Malacarne, p. 113, 114.

‡ Hierophilus was a Greek phyſician, a diſciple of Praxagoras, and cotemporary with Eraſiſtratus.

irregular

irregular cavity, which ſeems to be particularly ſtrengthened by theſe ſtrong faſciculi of fibres, which form the ſupport of the ſinuſes *. Ignorant of the circulation, imagining that the blood aſcended by the great jugular veins to the lateral ſinus, and ſeeing that the lateral ſinuſes opened into this central cavity, they conceived that the blood deſtined for the brain underwent an operation there, and was thence ſent through every part of the brain †.

OF THE LESSER SINUSES IN THE BASE OF THE SCULL.

Besides thoſe larger ſinuſes which we have deſcribed, and which convey back the great proportion of blood circulating in the brain, there is a ſet of leſſer ſinuſes which lurk betwixt the dura mater and the anterior part of the baſe of the ſcull. Theſe laſt are fully more intricate than the others; they lie upon the irregular ſurface of the ſphenoid, temporal, and occipital bones; and tend backwards to the great embouchoir formed

* "Deinde et illia per ſectionem ſcalpellum injiciens, ſurſum adigere conoberis ad uſque verticem ubi venæ duæ invicem congrediuntur; quam regionem Herophilus nominat lenon, torcular. Galen." Lib. Nonus de Cerebri, &c. Diſſectione.

† "Coeuntes autem in vertice capitis, quæ ſanguinem deducunt meningis duplicaturæ, in locum quendam vacuum quaſi ciſternam (quem ſane ob id ipſum Herophilus torcular ſolet nominare,) inde velut ab arce quadam omnibus ſubjectis partibus rivos mittunt; quorum numerum nemo facile dixerit, quod partium nutriendarum numerus ſit infinitus. Manant autem rivorum nonulli quidem ex medio ipſo loco in totum cerebellum, ſecti, ac derivati, eodem prorſus modo, quo ii qui in areolis, alii autem ex parte anteriore feruntur, ea ſcilicet qua torcular excipit dixeris utique velut rivum quendam ſanguinis, quem et ipſum ex craſſa meninge admodum ingenioſe fabricata eſt, partibus enim ipſius meningis quæ ſanguinem duxerunt ad torcular appulſis, dimiſſaque illinc aliqua in partes ſubjectas, non amplius, quod ſuperarat, uni venæ concredidit, ſed preterea ex craſſæ meningis partibus anterioribus extenſis rivulum efficit, ex quo primum multos rivulos per totam viam produxit." Galen, cap. vi. *de torcular. Et quo pacto venæ intra cerebrum diſtribuantur.*

by the irregular hole in the temporal and occipital bones.

THE SPHENOIDAL SINUSES.

THE SUPERIOR SPHENOIDAL SINUSES are feated in a fold of the dura mater, on the internal margin of the wing of Ingraffias, and before the great wing of the fphenoid bone; they receive the blood in part from the orbit and from the dura mater; they open into the cavernous finus, or perhaps into the opthalmic finus, which of courfe, for the moft part, conveys the blood into the fuperior or inferior longitudinal finus.

The INFERIOR SPHENOIDAL SINUS is very irregular and inconftant. It is in the dura mater, covering the great wing of the fphenoidal bone: the blood of this finus is emptied into the cavernous finus, or efcapes by emiffarii into the trunk of the temporal veins.

The ANTERIOR CLYNOID SINUS.—The pofterior clynoid finus, or eliptic finus, and the circular finus, are one and the fame; the difference confifts only in the manner of defcribing them; the CIRCULAR SINUS lies within the clynoid proceffes of the fphenoid bone, and furrounds the glandula pituitaria *.

As this circular finus opens upon each fide into the cavernous finus, it is not unaptly divided into two; the anterior half of the circle, being the anterior clynoid finus of fome authors; the pofterior half (which is in

* Ridley defcribes it in thefe words: "Another I difcovered by "having injected the veins with wax, running round the *pituitary* "*gland* on its upper fide, forwardly within the duplicature of the "dura mater, backwardly between the dura mater and pia mater, "there fomewhat loofely ftretched over the fubjacent gland itfelf, "and laterally in a fort of canal made up of the dura mater above, "and the carotid artery on each outfide of the gland, which, by "being faftened to the dura mater, above and below, at the bafis of "the fcull, leaves only a little interftice betwixt itfelf and the gland." (Accuratius tamen a Rilleyo defcriptus eft. Haller.)

But Ridley is affuming merit to himfelf. Brunnerus defcribes this finus.

general

general wider), the eliptical or poſterior clynoid ſinus, or ſemilunar.

This ſinus, like moſt of the leſſer ſinuſes, is irregular in its ſhape, its ſize, its communications, and its origin*. Its natural communication is with the cavernous ſinus, which in fact encroaches upon its ſide; it will be found to communicate alſo with the ſphenoidal ſinuſes, and the obliqui or petrous ſinuſes †: at one time the anterior half of the circle is wanting; at another the poſterior ‡.

THE CAVERNOUS SINUS.

THE cavernous ſinus is a great irregular centre of communication with the leſſer ſinuſes in the baſe of the ſcull. This ſinus is ſunk upon each ſide of the ſella turcica, and is formed in the irregular ſplitting of the lamella of the dura mater: it is of a triangular ſhape; it extends from the ſides of the ſella turcica, even to the foramen ſpinale §. The pointed extremity of the tentorium, which extends forwards from the angle of the petrous bone to the poſterior clynoid proceſs, covers and protects it. The cavernous ſinus is different from all the others; it is an irregular cavity, full of fibrous cords traverſing it, which gives it a kind of cellular appearance. It is like a diſeaſed part into which the blood had been driven, till the cellular texture had been diſtended and partly deſtroyed. After a minute injection, ſmall arteries are ſeen to ramify among theſe fibres; the internal carotid artery riſes through it, and the ſixth pair

* "Varie ſono le origini, e le foci di queſto ſeno. Alcune volte il "fondo della foſſa pituitaria vi invia due canaletti longitudinali, che "ſcorrono ſul dorſo di quelle due pieghe ſottili falcate ond-iè tripar-"tita la glandula pituitaria. Altre volte la foſſa diviſa per traverſo "da una ſimil piega che pure ha ſul dorſo il ſuo ſeno, allo elittico lo "invia." Malacarne, p. 123.

† Haller, tom. iv. p. 154.

‡ "Nunc anterior nunc poſterior ejus arcus amplior eſt; nunc an-"terior nunc poſterior ejus arcus deficit; nunc totus ipſi deſidera-"tur; interdum vere duplicem fuiſſe, referunt." Sommerring, vol. v. p. 354.

§ Malacarne.

of nerves is involved in it, in their paſſage from the ſcull.

This ſinus is the centre of the little ſinuſes and veins of the anterior part of the baſe of the brain and cranium: four or five veins pour their blood into it, from the anterior lobes of the brain and the foſſa ſilvii; ſometimes, even the opthalmic veins open into this receptacle *. The ſuperior and inferior petrous ſinuſes, and the baſilar ſinus, open into it behind; the circular before; the ſphenoidal ſinuſes and veins of the dura mater upon the ſide; while the right and left ſinuſes often communicate by means of the tranſverſe ſinus. Beſides theſe the petrous ſinuſes have ſeveral communications, or emiſſaria as they are called, viz. by the inferior orbitary foramen, the funnel of the carotid artery, through which deſcends a vein, (the vena ſodalis carotidis,) which terminates in the pterigoid plexus of veins, the ſphenoidal fiſſure, the interoſſeous ſinus of Malacarne †.

The TRANSVERSE, or POSTERIOR CLYNOID SINUS, runs acroſs from one oblique ſinus to another behind the poſterior clynoid proceſſes ‡. In its form it is not peculiar, nor is it very regular.

There are two PETROUS SINUSES, the anterior and poſterior, or the inferior and ſuperior ſinuſes; theſe two come off nearly together from the carvernous ſinus, and running back upon the petrous bone, terminate in the lateral ſinuſes or beginning of the internal jugular vein; but which two to take as petrous ſinuſes is a queſtion. For example, Malacarne ſhews that there is a ſinus, by no means uncommon, which belongs as ſtrictly as thoſe others to the petrous portion of the temporal bone.

He calls this new ſinus the anterior petrous ſinus; and

* This vein, the vena angolana, makes a very remarkable emiſſaria, but it is more probable that the blood in ſuch veins runs inwards than that it eſcapes from the ſcull to the external veins.—Cum venis poſterioribus frequentes nexus init. Sommerring, vol. v. p. 354.

† The Emiſſaria, 4ta. of Tabarini. Obſerv. Anatom. p. 42, et. ſeq.

‡ In truth the ſuperior, and inferior, or oblique ſinus, the cavernous, and the tranſverſe, meet nearly at a point.

the ſuperior of other writers, he calls the poſterior petrous ſinus; and the inferior petrous ſinus of other writers, as it lies more upon the cuneiform apophyſis of the occipital bone, and runs ſlantingly, he calls the oblique. I would on the contrary conſider two of theſe as the petrous ſinuſes; the oblique ſinuſes of Malacarne, as the lateral baſilar ſinuſes; and thoſe which run on the middle of the cuneiform apophyſis, as the middle baſilar ſinuſes.

The ANTERIOR PETROUS SINUS runs upon the anterior face of the petrous bone, from near the ſpinal hole *; whence, making a ſemicircular curve in the angle of the petrous and ſquamous portions of the temporal bone, it terminates in the lateral ſinus.

The POSTERIOR PETROUS SINUS † lies in that pointed extremity of the tentorium, which ſtretches forward, connected with the acute angle of the petrous bone. It is narrow; and a ſulcus or groove on the angle of the bone gives a partial lodgement to it; it paſſes from the cavernous ſinus to the great lateral ſinus.

The LATERAL BASILAR SINUS ‡ is ſhorter and larger than the laſt; and it makes an oblique curve from the cavernous ſinus under the pointed extremity of the tentorium, which is continued by the ſide of the ſella turcica, to the termination of the lateral ſinus, or rather into the beginning of the jugular vein, by a channel, ſeparated by a bony lamina from the termination of the lateral ſinus; or it is continued into a vein in the baſe of the cranium, which afterwards joins the great jugular vein.

The MIDDLE BASILAR SINUS. This ſcarcely deſerves the name of ſinus. It conſiſts, in general, of a few cellular-like communications, formed in ſtrong fibres of the dura mater, which here partakes of the nature of a liga-

* And here it has a tranſverſe branch of communication with the cavernous ſinus, which runs under the extended point of the tentorium.

† Or ſuperior petrous ſinus. Vicq d'Azyr.

‡ The inferior petrous, or oblique ſinus.

ment. Theſe open into the laſt-mentioned ſinus, or ſometimes into the vertebral vein.

The VERTEBRAL SINUSES are veins included in the lamellæ of the dura mater; and, divided into right and left; they deſcend into the tube of the vertebræ, on its fore-part, and paſs down even to the ſacrum. They are connected in all their length with the vertebral, dorſal, and lumbar veins. Theſe ſinuſes, or veins, at each vertebra, are joined by a tranſverſe branch; they are connected at the top of the ſpine with the baſilar or anterior occipital ſinuſes.

EMISSARIA SANTORINI.

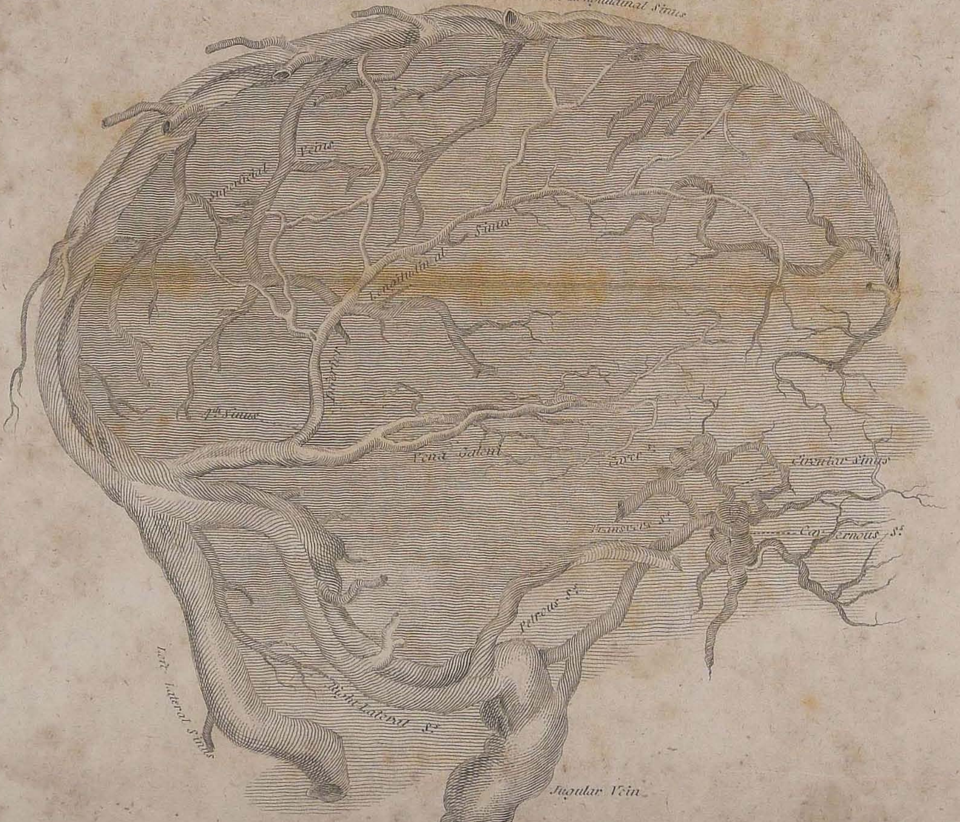
"VENÆ EMISSARIÆ" is but another name for thoſe leſſer veins which form communications between the ſinuſes within the head, and the external veins in the baſe of the cranium. Theſe, then, are chiefly the opthalmic *, maſtoidean, and vertebral veins. But the vena ſodalis arteriæ carotidis, the ſmall vein which penetrates the parietal bone by the ſide of the ſagittal ſuture, even the venæ arteriæ meningeæ ſodales, and the little veins which paſs with ſome of the nerves, or through the fiſſures of the bone, are alſo brought into account. To theſe a much greater importance has been attached than they merit; particularly in apoplectic affections of the head, they have been ſuppoſed to be eminently uſeful in emptying the ſurcharged ſinuſes and veins of the brain into the external veins.

But thoſe leſſer paſſages for the blood, ſuppoſing us to be aſſured that the blood flowed through them, from the ſinus to the external veins, are inſignificant, when compared with the great out-let of the INTERNAL JU-

* "Je me ſuis convainçu, par des diſſections multipliées, que les "ſinus caverneux & orbitaires communiquent, par un plus grand nom-"bre de veinules, avec les arrières-narines, de ſorte que les hémorrha-"ges critiques qui ſe font par les nez, dans les fièvres aiguës, où la "tête eſt affectée, s'expliquent facilement par ce moyen," &c. Vicq d'Azyr, Acad. Royale, 1781, p. 504.

GULAR

Plan of the Sinuses



Engraved by D. Lizars.

GULAR VEIN; to which we have ſeen all the ſinuſes tend. But the accumulation of blood in the veſſels of the brain is ſeldom mechanically produced; it is a diſeaſed action of the ſyſtem of the brain, to which we become more and more liable as we advance in years: and perhaps it is owing to the ſame gradual change which is operating on the venous ſyſtem from infancy to old age.

The importance of the ſinuſes in the circulation of the blood in the brain, is either vaguely deſcribed, or imperfectly underſtood by authors. We find it ſaid, that the ſinuſes ſupport the blood againſt compreſſion, and protect its free circulation. This to me ſeems an erroneous idea. The leſſer veins are, as in other parts of the body, and have no ſuch proviſion; and ſince, within the head, there can be no ſuch partial compreſſion as in the limbs, any cauſe which would compreſs the greater veins, were they not ſupported, muſt fall upon their extremities with worſe effect. The circulation is the only power which can act mechanically upon the brain; but this can never cauſe a compreſſion of its veins, becauſe the increaſed action of the arteries muſt tend more to the diſtention of the veins than it will be the occaſion of the brain compreſſing them.

The more general idea conceived of the uſe of the ſinuſes is nearer the truth; *viz.* to prevent the ſudden and violent action of the muſcles of reſpiration, or of the muſcles of the head and neck, from injuring the ſmaller veins of the brain, by expelling the blood into the internal jugular veins that the ſinuſes prevent the impulſe from being communicated to the blood in the ſmall and tender veins of the brain, which might endanger a rupture of them *. Yet this is not exactly the manner in which the ſinuſes preſerve the leſſer veins; they do not ſuffocate nor take off the force of the impulſe from the regurgitating blood, ſo much as they would do if they were like the trunks of veins in other parts; becauſe, being incapable of diſten-

* Monro, Nervous Syſtem, p. 4.

tion, they throw the undulation of the blood, when it is thus checked in its exit, backwards upon the extremities of the veins. But then the effect is, that no particular vein or trunk receives the ſhock; all ſuffer in a leſſer degree, and equally, which is their ſafety. All the veins in the baſe of the brain, which would be liable to rupture, or diſtention, from receiving, in their ſudden turns, the ſhock of the blood, checked by the muſcles of reſpiration, or otherwiſe, are preſerved by being incloſed in ſinuſes, and covered by the ſtrong lamellæ of the dura mater. The leſſer veſſels again are removed from the ſhock: its force is ſpent, becauſe it has ſpread among many branches; and it has become a general impulſe upon the brain, which the brain reſiſts, becauſe it is imcompreſſible.

That the brain does receive ſuch an impulſe, in violent coughing and ſtraining, is ſufficiently evident from the riſing of its ſurface on theſe occaſions, when it is accidentally laid open by fracture, or the trepan *.

Although the obſtruction of the jugular veins were to cauſe no regurgitation of the blood; although the ſinuſes were ſuppoſed to have an effect in preventing the diſtention of the veins, or return of the blood to the head; ſtill one effect of the continued action of the arteries is, to increaſe the plethoric ſtate of the brain, when there is a ſtagnation, or more or leſs remora, of the blood in the ſinuſes; and thence it is, that in every interruption to the free exit of the blood, the diſtention muſt ultimately fall upon the extreme veſſels †.

We

* The older phyſicians, obſerving the connection betwixt the motion of reſpiration and of the brain, conceived that the air was drawn through the noſe and cribriform bone into the brain, ſo as to diſtend it. Upon this hypotheſis followed many wonderful caſes.

We have already mentioned the hypotheſis which ſuppoſed compreſſion and relaxation of the cerebrum and cerebellum alternately, by the action of the falx and tentorium.

† We ſhall ſay that theſe veſſels cannot ſuffer diſtention, unleſs there be ſpace given for their inordinate dilatation, by blood proportionally

We ought not to confound the idea of incompressibility of the brain with that of a solid substance, which would allow no motion in the vessels within the cranium, and would require us to invent some specious means to account for the circulation of the blood in the brain, different from that of the other viscera of the body. Were the brain thus incompressible, or rather solid, so as to prevent a free action of the vessels within the cranium, then, as the blood enters with an evident pulsation, it must necessarily have returned by the veins with a distinct pulsation; but this pulsation is lost here, as in the other vessels of the body, before it returns by the sinuses. When the blood is sent into the arteries of the brain, by the stroke of the heart, they dilate; and this dilatation the pliability of the brain allows, by throwing a comparative degree of pressure upon the veins. Again, when the arteries (during the dilatation of the heart) are in action, and contract, their blood enters the veins, so as to give to them a degree of dilatation equivalent to their former compression, and which now gives the freedom of contraction in return to the arteries; without any compression, therefore, of the brain into a lesser space, there is an activity allowed in the vessels.

This degree of motion, communicated through the brain, is very small, nor does it affect the function of the brain; as we see, when the scull is laid open, and the pulsations of the arteries are, as it were, accumulated, in their effect, to one point; for here the patient does not suffer, although the brain beats so as to be sensible to the eye. The circulation of the blood in the brain may be obstructed, or it may be accelerated, until

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tionally sent out from the cranium. But there is a degree of distention upon them, a tension which cannot be relieved, nor the contraction of the arteries allowed. The impulse from the heart and arteries is still continued, and is increasing the evil. Bleeding here relieves this action, and diminishes the danger; and by this means we can suit the activity of the vessels entering the brain, to the temporary remora in those which convey the blood out of the head.

this velocity affects the function*: or too much blood may be accumulated within the cranium; but during this accumulation of the blood there must be a proportional space, freed by the absorption of the brain itself, or the partial accumulation in one part of the vascular system of the brain must be accompanied by a deficiency in the other.

CHAP. III.

OF THE VENTRICLES AND INTERNAL PARTS OF THE BRAIN.

OF THE CAVITIES OF THE BRAIN IN GENERAL.

THERE are within the brain many tubercles and irregular surfaces, of which it is infinitely more difficult to convey an idea by description than of the external parts. These surfaces, as the name implies, lie in contact without adhering; and form what we call, though not perhaps with strict propriety, the cavities of the brain. Not being separated, they are scarcely to be considered as cavities, although they be capable of distention by the infiltration of the fluid into them. The surface of the cavities or ventricles of the brain is naturally

* There is much found reasoning and ingenuity wasted on the subject of the circulation of the brain: As the gentle murmuring of a stream, says Lower, lulls to repose, while the mind is disturbed, or the imagination awakened by the din of a cataract; so sleep is induced by the gentle flow of the blood in the brain, or is disturbed when the circulation is accelerated. As the fatigue and rest of the body required a variation in the impetus of the blood towards it, the necessary consequence was a variation in the degree of velocity in the circulation and quantity of blood in the head, and this to Lower is the reason of the vicissitude of wakefulness and sleep. The simple fact of the effect of pressure upon the surface of the brain inducing an oppression of the senses has occasioned all their theories of sleep to turn upon this one idea of pressure on the brain.

 bedewed

bedewed with a fluid or halitus, which flows from the general ſurface of the ventricle, and from the plexus choroides. This moiſture preſerves thoſe ſurfaces from adheſion; during life and health it is not accumulated ſo as to form a fluid; but in many diſeaſes, and after death, it is effuſed or collected into a fluid. The external convolutions of the brain we have ſeen to be cineritious on the ſurfaces: the internal ſurface of the brain may be conſidered alſo as forming convolutions; but they are chiefly medullary, and are more irregular, or rather have a greater variety of ſhape, than thoſe of the outer ſurface.

In regard to the uſe of the ventricles of the brain, ſince the hypotheſes of the older phyſicians have been tacitly rejected, no opinion has been offered, except this, that "they ſeem to be made of a neceſſary conſe-" "quence, and towards the greater uſe and diſtinction" "of parts;" or, as we have already had occaſion to mention, that the ventricles ſerve to increaſe the ſurface of the pia mater, and that whatever may be the purpoſes which are ſerved by that membrane on the ſurface of the brain, we muſt ſuppoſe the ſame to be performed by it within the ventricles. But this is a concluſion which may not be altogether ſatisfactory to an inquiſitive mind.

It is neceſſary to take into conſideration the general peculiarities of the brain: we find that within the ſcull there is no adipoſe ſubſtance, though it pervades every other part of the body. We at once ſee a reaſon for this. It is evident that as the fat is ſo inceſſantly undergoing changes (being alternately abſorbed and depoſited); as at one time it is depoſited in greater quantities and at another abſorbed; as it is in perpetual variation according to the prevailing habits of the body, the proportion of exerciſe taken, or the ſtate of the health; its continual changes would have the very worſt conſequence upon ſuch a part as the brain; that if accumulated it would oppreſs the circulating veſſels; if rapidly abſorbed it would be followed by accumulation or ſurcharge of the veſſels; for the ſcull does not allow of

 diſtention,

diſtention, nor is it poſſible that the cavity of the cranicum can admit of depletion.

I conceive the ventricles to be a proviſion for allowing thoſe changes to take place, which neceſſarily, from time to time, ariſe, or are occaſioned by diſeaſe in the ſubſtance of the brain itſelf: they prevent an inſtantaneous bad effect. When fluids diſtend the ventricles, it ſometimes occurs to us that the fluid, ſecreted and accumulated, muſt have compreſſed the ſubſtance of the brain, and cauſed its abſorption; but I conceive that frequently the cauſe is reverſed; the abſorption of the maſs of the brain being the diſeaſe or its conſequence, and the fluid being poured out in the ventricles to ſupply this deficiency: I alſo conceive that the collected fluid being in the central parts, is a particular proviſion by which the whole maſs of the brain is kept uniformly diſtended; whereas, if the ſurface had been equally, or more diſpoſed to ſuch ſecretion of fluid, the internal parts would have fallen flaccid, and been compreſſed rather than ſupported.

There cannot be a more erroneous notion than that in hydrocephalus the compreſſion produced by the ſecreted fluid occaſions the waſting of the brain. In that diſeaſe the ſubſtance of the brain is not firm and compreſſed, ſo as to prevent the veins from being completely filled; but, even in a very early ſtage, the maſs of the brain is ſoft and fluid; the veins peculiarly diſtended or enlarged; and from the firſt or inflammatory ſtage of the acute hydrocephalus, to its termination, the diſeaſe is not a dropſy of the ventricles, but a univerſal affection of the brain. The effect of the diſeaſe is, that there is a change in the relative powers which inceſſantly ſecrete and abſorb the brain itſelf, as every other part of the body is ſecreted and abſorbed. And in conſequence of this there is a diminution of the ſolids of the brain, and an accumulation of the fluids to ſupply their loſs.

It is not to be ſuppoſed that the ancients, ſo fertile in their hypotheſes, and ſo eaſy in their proofs, could neglect the evident importance of the ventricles of the brain.

brain. We accordingly find that the ſpirits were manufactured in theſe cavities; that they were the "ſpirituum animalium officina," whence the ſpirits were conveyed over all the nervous ſyſtem *. They were again degraded from this higher office, and became the mere receptacles of the excrementitious matter of the brain (meras cloacas eſſe aſſeruerint †); and Willis ſeems inclined ſtill further to degrade the importance of the ventricles, by conſidering them merely as of ſecondary importance; or rather as reſulting ſolely from the accidental conformation of the brain ‡. Again, we find it a prevalent opinion that the ventricles contained air; that the air ſupported the ſoft medullary ſubſtance of the brain; and that it gave motion to the whole maſs, ſo as to circulate the ſpirits in the ſubſtance of the brain §.

OF THE CORPUS CALLOSUM AND CENTRUM OVALE OF VIEUSSENS.

THE CORPUS CALLOSUM is a medullary body which is a centre of communication; or it is the great commiſſure ‖ paſſing betwixt the hemiſpheres of the cerebrum **: it is ſeen without inciſion by merely ſeparating thoſe

* Lately, by chemical aids, (which makes the cineritious ſubſtance black, or dark brown, while the medullary matter remains white, or takes a ſlight greeniſh tinge,) the origins of many of the nerves have been traced into the ſubſtance of the brain, even to the ſurface of the ventricles, which has given occaſion to the revival of ſimilar ideas of the uſe of the ventricles.

† Willis Cereb. Anat. p. 32.

‡ " Porro ſi quis cerebelli fabricam exacto conſiderat, et ſerio per-" pendit, quod hi ventriculi non ex primaria naturæ intentione effor-" mentur, at ſecundario tantum et accidentaliter de cerebri compli-" catione reſultent," &c.

§ Malpighi.

‖ Commiſſure is a term applied to thoſe tracts generally of medullary matter, which paſſing through the brain are ſuppoſed to be a medium of communication.

** Willis conceiving the ſpirits to lodge and circulate in the ſuperficial convolutions of the brain, (upon the conformation of which depended the capacity or ability,) gives to the corpus calloſum the property of collecting and concentrating the ſpirits, " quaſi in *publico emporio*

thoſe hemiſpheres with the fingers. It is a white body, firmer than the reſt of the medullary ſubſtance. It is but ſlightly convex upon its upper part, but turns convex downwards upon the fore and back part. As the corpus calloſum is the continuation of the internal medullary ſubſtance of the brain, it is ſuperfluous to ſay that it is continued down, anteriorly, into the medullary matter betwixt the corpora ſtriata, terminating in its pedunculi; or, backwards, that it is continued with the fornix and cornua ammonis and the ſurface of the poſterior prolongation of the lateral ventricle.

We ſee upon the ſurface of the corpus calloſum two medullary lines conſiderably raiſed, running parallel to each other * in the length of the body. Betwixt theſe ſalient lines there is of courſe a kind of rut, called ſometimes the rapha, or ſuture, which may be conſidered as dividing this body into two equal parts, and which, in truth, forms the accurate diviſion of the two ſides of the whole brain †.

Other lines, leſs elevated from the ſurface, are to be obſerved running acroſs theſe, as if paſſing from one hemiſphere to the other. If the corpus calloſum be cut horizontally, and the ſection be continued into the ſubſtance of the hemiſpheres, we ſtill can perceive thoſe

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emporio commorantur;" and here they were depurated by repeated circulation.—But the language in which all this is delivered, better veils the abſurdities of the doctrine: "ſpiritus recens nati undequaque ab extima hujus corporis ora verſus anteriorem iſtius corporis calloſi partem, ubi craſſimum exiſtit, perpetim blande ſcatent; ibidemque, ſi opus fuerit, aut imaginationis actui impenduntur, aut medullæ oblongatæ crura ſubeuntes, appendicem nervoſam actuant et inſpirant." What remains ſuperfluous of the ſpirits returns backwards and circulates through the fornix, and is ſtill farther ſubtilized, "hoc motu ſubtiliores quoſdam phantaſiæ actus peragunt."

* They are not ſtrictly parallel in all their length; we find them often ſeparated both upon the fore and back part; but generally more ſeparated upon the back part, and even ſometimes they are curved.

† In which conceit Duverney calls this "clef du cerveau," from its being the centre of communication. Tom. i. p. 39.

tranſverſe lines, and obſerve them to be loſt in the medullary matter of the hemiſpheres *.

THE CENTRUM OVALE is merely the appearance which the white and internal part of the cerebrum takes when the brain is cut horizontally on the level of the corpus calloſum; for then the corpus calloſum is the centre of the great medullary maſs of the cerebrum, and the cineritious matter being on the external edges only, forms the central white maſs into an irregular oval.

THE SEPTUM LUCIDUM.

THE two lateral ventricles lie under the corpus calloſum and medullary centre, they are divided by a partition, which deſcends from the lower ſurface of the corpus calloſum, and reſts upon the fornix. This ſeptum of the ventricles is tranſparent, and conſiſts of two lamina, and theſe conſiſt of medullary and cineritious matter †. Betwixt theſe lamina is the cavity of the ſeptum lucidum ‡. The ſize and ſhape of this cavity differs in a variety of ſubjects. It is of a triangular ſhape, and from eighteen to twenty lines in length §. It has a fluid exhaling into it like the ventricles, and is by ſome counted as a fifth ventricle: according to Santorini it opens in the baſe of the brain, oppoſite to the union of the optic nerves. Vieuſſens deſcribes it communicating with the third ventricle ‖. Winſlow alſo has ſeen it reaching a great way backwards, and conceives it to open into the third ventricle.

* The neceſſity of explaining paralyſis and convulſive motions of that ſide of the body oppoſite to the ſide of the brain injured, have made anatomiſts attend to thoſe tranſverſe lines, in the hopes of finding ſuch a decuſſation of theſe lines as would account for it. Sabbatier ſays, they have brought themſelves to believe that there was a decuſſation, but after careful inveſtigation he could find no ſuch thing. See Winſlow. Ludwig (de Cinerea Cerebri, ſub. p. 5.) obſerved ſtriæ of cineritious ſubſtance in the corpus calloſum. See alſo Gunz. and Haller.

† Vicq d'Azyr.

‡ It was diſcovered by Silvius. See alſo Santorini.

§ Sabbatier.

‖ "In qua pellucidum non raro reperimus aquamque haud dubie "in tertium illabitum ventriculum." Vieuſſens de Cerebro, p. 59.

tricle. Soemmerring defcribes it as large in the middle, contracted backwards, and having no communication; but he afferts that it is fhut in on every fide *. In the bafe of the brain we find a narrow longitudinal fulcus betwixt the pedunculi of the corpus callofum. In the bottom of this cavity there is a medullary lamina, which Vicq d'Azyr calls "*Cloifon à la cavite du feptum lucidum.*" And the fulcus he calls "*Foffe de la bafe du* SEPTUM LUCIDUM." By a careful fection of this medullary fubftance we lay open the cavity of the feptum lucidum.

* De Corporis Humani Fabrica, tom. iv. p. 55.

LATERAL

LATERAL VENTRICLES.

UNDER the corpus callofum and medullary centre, are the lateral ventricles. They are diftinguifhed into right and left. They are of a very irregular fhape, ftretching into three prolongations or cornua, whence they have the name of tricornes. They are the great ventricles of the brain; the third and fourth being comparatively very fmall. What may be confidered as the bodies of thefe ventricles are formed betwixt the corpus callofum and medulla of the brain, and the convexity of the corpora ftriata and thalami-nervorum opticorum. Following the cavity forwards, we find what is called its ANTERIOR HORN or finus, formed betwixt the more acute convexity of the corpus ftriatum and the anterior part of the corpus callofum; into the pofterior lobe of the cerebrum, refting upon the tentorium, there ftretches backwards with fome confiderable curve, and, at the fame time, with a flight inclination downwards, the POSTERIOR HORN.

Again, the INFERIOR OR DESCENDING HORN is like the continued cavity of the ventricle; it takes a curve backwards and outwards, and then turning forwards it defcends into the middle lobe of the brain.

The lateral ventricles do not terminate in the others by any of thofe prolongations; but they communicate, upon a very high level, with the third ventricle and with each other, by a wide opening, formed under the fore-part of the arch of the fornix. This communication we eafily find by following the choroid plexus forward and under the fornix: it is a fpace betwixt the moft anterior part of the convexity of the optic thalami and the anterior crura of the fornix.

OF THE PARTS SEEN IN THE LATERAL VENTRICLES.

THE FORNIX is a medullary body, flat, and of a triangular fhape: its lower furface is towards the third ventricle:

ventricle: its lateral margins are in the lateral ventricle. On its upper ſurface it ſupports the ſeptum lucidum, or partition of the two lateral ventricles, and under its moſt anterior part is the communication betwixt the lateral ventricles and the third ventricle *. One of the angles is forward, and the other two towards the back part: it reſts chiefly upon the thalami nervorum opticorum, but it is ſeparated from them by a vaſcular membrane, which is continued from the external pia mater, and which ſtretches into the brain betwixt the poſterior part of the corpus calloſum and tubercula quadrigemina, and which membrane connects the plexus of the lateral ventricle. The fornix leaves betwixt it and the convex faces of the anterior parts of the corpora ſtriata, a triangular ſpace, which is in part occupied by the ſeptum lucidum.

The extremities of this body are called crura. The poſterior crura coaleſcing with the corpus calloſum, (which is continued downwards poſteriorly,) are prolonged into the hippocampi, and the anterior crura forming the anterior angle being cloſe together, bend downwards behind the anterior commiſſure, and are connected with it: they then bend round the thalami, and may be traced into the crura cerebri; or, according to others, they form the corpora albicantia †. Thoſe pillars or crura of the fornix are fibrous in ſome ſlight degree like a nerve. This is to be obſerved by cutting them either acroſs or in their length ‡.

Upon the lower ſurface of the fornix there are lines like thoſe of the corpus calloſum, and which are erroneouſly conceived by many to be the impreſſion of the veſſels of the velum. It is this lower ſurface of the fornix

* Of this communication ſee farther in the Anatomy of the Brain illuſtrated by engravings.

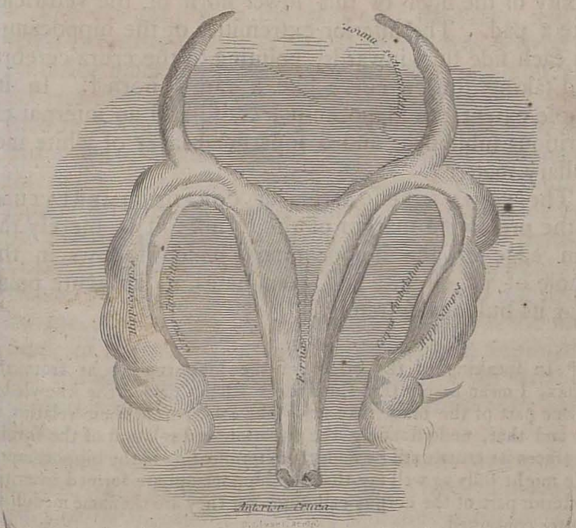
† Two white bodies ſeen on the baſe of the brain behind the infundibulum.

‡ Vicq d'Azyr, Acad. Scien. 1781. p. 517.

fornix which is called LYRA, CORPUS PSALLOIDES, it being compared to a ſtringed inſtrument *.

OF THE HIPPOCAMPI, OR CORNUA AMMONIS, AND OF THE TENIA HIPPOCAMPI.

Plan of the Connections of the Fornix with the Hippocamp! &c.



* The prevalent idea amongſt the older authors regarding the uſe of the fornix was, that it acted like a ligament binding together the internal parts of the brain; or that it ſupported the incumbent weight of the upper parts of the brain from preſſing upon the lower. "Verum alter atque iſte inſignior fornicis uſus eſſe videtur quem modo innuimus; nempe ut ſpiritus animales per ejus ductum ab altera cerebri extremitate ad alteram immediate tranſeant, atque ita quaſi per pelicani roſtrum in ſui ipſius ventrem intortum circulentur." Willis.

THOSE

THOSE parts are to be ſeen continued from the poſterior crura of the fornix. We have obſerved, that upon the back part, the fornix adheres to, or is continuous with, the corpus calloſum. We ſhall find alſo that its poſterior crus on each ſide divides into two lamina of medullary matter: the one of theſe is continued into the cornu ammonis, and the other (being the anterior of theſe portions) forms the tenia hippocampi.

The hippocampos is narrow at its commencement in the poſterior crus of the fornix *; but it is enlarged as it deſcends, following the courſe of the inferior prolongation of the lateral ventricle towards the baſe of the brain. It is, indeed, merely a relief or particular convexity of the floor of this lower horn of the ventricle, like a pad. The inferior extremities of the hippocampi on each ſide turn inwards, pointing to the crura cerebri, and taking thus a curve like a ram's horn †. In its whole extent the hippocampos conſiſts of an internal cineritious ſubſtance, and a ſuperficial layer of white medullary matter ‡.

The TENIA HIPPOCAMPI, OR CORPUS FIMBRIATUM, is the prolonged margin of the fornix: it is merely the thin edge of the hippocampos, which follows in the whole of its circuit, and terminates in an acute point near its bulbous extremity.

* In ſpeaking of the origin of the hippocampos as from the fornix, I mean ſimply that the ſtudent having gained the knowledge of one part of the brain may trace the others from their relation to it, and that, underſtanding the ſituation and relation of the fornix, he traces its crura until he finds them terminating in the hippocampos. We might fully as well ſay that the hippocampi are formed from the poſterior part of the corpus calloſum, for they are the ſame medullary matter continued.

† Betwixt the extreme point of the hippocampi and the crura cerebri (when the baſe of the brain is turned up) we can inſinuate the probe into the inferior horn of the lateral ventricle without piercing the ſubſtance of the brain, but merely tearing the pia mater.

‡ "Vers la partie inferieure et poſterieure du corps calleux, on "trouve, de chaque côté, un petit bourrelet de ſubſtance griſe qui "ſe prolonge dans l'epaiſſeur de l'hypocampe dont il fait partie: ce "bourrelet eſt recuvert dans ſon principe par une lame de ſubſtance "blanche." Vicq d'Azyr, loc. cit.

The LESSER HIPPOCAMPOS, or COLLICULUS, is a relief or convexity in the floor of the pofterior horn of the ventricles, which may be traced backwards from the crura of the fornix. It has the fame relation to the fornix which the greater hippocampos has, and lies in the pofterior horn or prolongation of the ventricle into the pofterior lobe of the brain, in the fame way in which the great hippocampos lies in the inferior horn or prolongation of the ventricle into the middle lobe of the brain.

The velum and plexus require to be taken away before we can fully underftand the fituation of the third ventricle, or of thofe tubercles which are but partially feen in the lateral ventricles.

The VELUM lies in the centre of the brain, and extends from the furface of the brain inwards betwixt the pofterior lobes of the cerebrum and the cerebellum, then betwixt the corpus callofum and nates and teftes, and then under the fornix. It forms thus a great communication betwixt the external and internal membranes of the brain. As it lies under the fornix, that medullary lamina adheres to it, while the velum again adheres to the thalami nervorum opticorum. Its margin feems to to be terminated laterally by the choroid plexus (when we view it after raifing the fornix); but it is not ftrictly fo, for the choroid plexus is continued with the membrane of the ventricles, and has no where a termination. For the vafcularity of this membrane, turn to what has already been faid in fpeaking of the internal veins of the brain.

Seeing how the plexus choroides are formed and connected, they cannot be ftrictly faid to have either beginning or termination; they are the connected folds and plicæ of the internal membrane of the ventricles loaded with veffels; but to defcribe them intelligibly we muft, notwithftanding, trace them in this manner. The PLEXUS of the LATERAL VENTRICLES rife from the bottom of the inferior horns of thefe ventricles betwixt the pedunculi or crura cerebri and the termination of the hippocampi; they lie like flefhy bodies in that lower horn.

horn. As they riſe into the ſuperior level, they are at their greateſt ſize (there they have often a diſeaſed appearance, being hard, and as if ſchirrous or full of little veſicles or hydatids); they then paſs forwards and inwards; diminiſhing in thickneſs until they coaleſce under the fornix, and immediately behind the communication betwixt the ventricles. The PLEXUS OF THE THIRD ventricle, formed by the union of thoſe of the lateral ventricles, turns back upon the lower ſurface of the velum, and is comparatively very ſmall.

The CORPORA STRIATA are ſmooth, cineritious convexities in the fore-part of the lateral ventricle. They are ſomewhat of the ſhape of a pear; they are obtuſe forwards; they approach each other towards the fore-part with a regular convexity, and they are narrow as they paſs backwards, ſeparating at the ſame time; their poſterior extremity being as it were puſhed out by the thalami nervorum opticorum. Theſe laſt lie more under the back part of the fornix, and are more concealed when the lateral ventricle only is laid open. The corpora ſtriata, are ſo called from the inter-mixture of the medullary matter in their ſubſtance, which gives the appearance of ſtriæ when they are cut. They deſcend down to the baſe, and give origin to the firſt pair, or olfactory nerves *. The ſtriæ of medullary matter paſs from above downwards, they therefore appear in the horizontal ſections of this body like white points. A ſuperficial horizontal ſection of the corpora ſtriata ſhews thoſe ſtriæ connected with the medullary matter of the middle and poſterior lobe. A deeper inciſion brings into view a maſs of cineritious ſubſtance betwixt thoſe ſtriæ and the medullary matter of the middle lobe. Another inciſion ſhews the courſe of the ſtriæ altered, and brings into view the connection betwixt the corpora ſtriata of each ſide, by means of the anterior commiſſure †.

The

* Soemmerring.

† " *Hæc pars commune ſenſorium eſt*, quod ſenſibilium omnium " ictus a nervis cujuſque organi dilatos accipit adeoque *omnis ſenſionis* " *perceptionem efficit*; cujuſmodi ſenſibilium ictus, cum hinc ulterius " in

The COMMISSURA ANTERIOR is a cylindrical medullary cord, which unites the fore and lower part of the corpora ſtriata, and which ſpreads its connections for a full inch and a half into the middle lobe of the brain upon each ſide. We ſee it ſtretched tranſverſely immediately under the anterior crura of the fornix. It is in figure like a bow; its extremities ſtretching (with a convexity forward) into the middle portion of the brain towards the extremity of the foſſa ſilvii, where it terminates in the medullary matter of the middle lobe of the brain.

The THALAMI NERVORUM OPTICORUM are hid by the poſterior angles of the fornix, and the plexus choroides: we do not ſee them fully until we have lifted the fornix and the velum or membrane which ſtretches under the fornix. They are ſomewhat of an irregular oval ſhape; they are whiter than the corpora ſtriata, their ſurface being chiefly of medullary matter. Internally they are cineritious; and the medullary and cineritious matter is blended in ſtriæ like the anterior tubercles of the ventricles or corpora ſtriata.

The thalami nervorum opticorum, having their convex ſurface towards each other, unite under the fornix by what is called the COMMISSURA MOLLIS, in oppoſition to the commiſſura magna, which is the corpus calloſum; the commiſſura anterior, which unites the fore-part of the corpora ſtriata; and the commiſſura poſterior, which is yet to be deſcribed.

This ſoft commiſſure of the brain, or the union of the optic thalami, is ſo ſoft that the ſlighteſt force will tear it, or in diſſection, the parts being unequally ſupported, the thalami will be ſeparated and this connection loſt *. After ſuch ſeparation of the tubercles there

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" in cerebrum trajiciuntur, *ſenſioni* ſtatim imaginatio ſuccedit; atque " inſuper hæc corpora, uti ſenſuum omnium impetus, ita motuum " localium ſpontaneorum primos inſtinctus ſuſcipiunt." Willis, Edit. 4. p. 43.

* Morgagni and Vicq d'Azyr ſay they have ſeen this commiſſure double.

 remains

remains very little appearance of their having been united. Sabbatier, after the moſt careful diſſection, ſays expreſsly that he could never obſerve this union, and he conceives, that in the ſmoothneſs of the contiguous ſurfaces he has a proof of there never being ſuch a union; but he goes on to ſay, "The fruits of my "reſearch were, that I conſtantly found a ſoft cord of "a cineritious colour, and about a line or a line and a "half in diameter paſſing betwixt them."

I have ſeen, when the ventricles were diſtended in hydrocephalus, and the communication betwixt the three ventricles enlarged to a ſquare cavity of nearly an inch in diameter *, that this union was drawn out to ſome length, but ſtill was above half an inch in diameter. The commiſſura mollis is exceedingly ſoft, of a cineritious colour, and veſſels are ſometimes ſeen to croſs upon its ſurface. It ſeems to be the continuation of the grey or cineritious ſubſtance which covers the internal ſurface of the optic thalami †.

Towards the fore-part of the thalami we have to obſerve a peculiar eminence or convexity, viz. the ANTERIOR TUBERCLES of the optic thalami. In making a horizontal ſection of the thalami, we find that we cut acroſs a medullary ſtreak or cord which deſcends from this tubercle to the mamillary proceſſes, or corpora albicantia, in the baſe of the brain ‡. Its courſe is deep in the ſubſtance of the brain, and ſomewhat oblique. The limits of the thalami externally are contiguous to the corpus ſtriatum, but betwixt them there intervenes a white medullary tract, which is continuous with the medullary ſtriæ, and which, as it marks the limits of the two great tubercles of the lateral ventricles, takes a courſe inwards towards the anterior pillars or crura of the fornix and middle of the anterior commiſſure. The

* In quadrupeds the adheſion is more extenſive.

† Mais il n'y a point de continuité, proprement dite, entre la ſubſtance intime de ces couches et la commiſſure molle dont il s'agit. Vicq. d'Azyr, Planc. de Cerv. p. 23.

‡ See Vicq. d'Azyr, plate xii. Mem. de l'Acad. Royale, 1781, p. 528, and plate 2, fig. 5.

ſurface of this tract, as ſeen in the lateral ventricle, is the TENIA SEMICIRCULARIS GEMINUM, which we ſhall preſently more particularly deſcribe.

To underſtand the further connections and importance of the optic thalami we muſt diſſect the baſe of the brain. There we find that it is through the corpora ſtriata, and the thalami nervorum opticorum, that the crura cerebri eſtabliſh their extenſive connection with the internal maſs of the brain; particularly we find that the crura ſhoot up into the back and lower part of the thalami.

Here on the lower part alſo we may obſerve the TRACTUS OPTICUS, which we may trace backwards from the optic nerves. They ſurround the crura cerebri with a ſemi-circular ſweep, ſwelling out at the ſame time, and terminating in three conſiderable tuberoſities: they are finally confounded with the lower part of the optic thalami *; at the ſame time there runs up a diviſion of it into the nates.

The TENIA SEMICIRCULARIS GEMINUM is the tract of the medullary matter, which is betwixt the two great anterior tubercles of the lateral ventricle, the corpus ſtriatum and thalamus nervi optici. Towards the fore-part of this tract its ſurface is covered with a layer of a ſemi-tranſparent greyiſh matter, through which we ſee the veins which paſs from the ſurface of the corpora ſtriata to join the vena Galeni †. Sabbatier makes the anterior extremity of this medullary body join the anterior pillar of the fornix: Haller makes it join the anterior commiſſure: and Vicq d'Azyr ſays they ſeparate

* Willis ſeeing the firſt and ſecond pair of nerves ſo cloſely connected with theſe tubercles, and ſuppoſing, as we have mentioned in a former note, that the corpora ſtriata were the common ſenſorium, concludes, "hinc ratio patet, cur odores ſine olfactus objecta "ipſum adeo cerebrum feriunt, et immediatè afficiunt; item cur "inter viſionem et imaginationem communicatio citiſſima habetur." P. 44.

† "Quelquefois il ſe detache du tænia ſemicularis entre le "corps ſtrie et la couche optique un filet blanc, que faiſſant un angle "très aigu, ſoit en devant, ſoit en arrière, monte à une certaine "hauteur ſur le corps cannele." Vicq d'Azyr, Mem. de l'Acad. Royale, 1781, p. 530.

again, where they ſeem to unite forwards and loſe themſelves on the corpora ſtriata. Their poſterior extremities are loſt in the hippocampi; they thus form a kind of longitudinal commiſſure which eſtabliſhes a communication betwixt the fore and back part of the cerebrum.

OF THE THIRD VENTRICLE.

THE third ventricle does not at all anſwer to the conception we form of the ventricles from the lateral ones. It is a mere ſulcus, lying betwixt the thalami nervorum opticorum, and betwixt the crura cerebri, which are continued down from theſe tubercles. It is a longitudinal ſlit, rima, or gutter-like cavity, which is made irregular, and is divided by the union of the optic thalami; and finally, it is canopied by the fornix and vaſcular velum which ſtretches over the thalami *.

Plan of the communication
of the Lateral & 3d. Ventricles
Repreſented by a perpendicular Section.

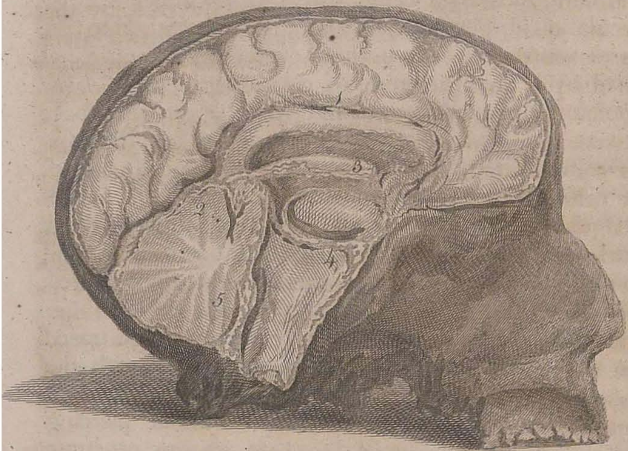
* "Hanc caveam ventriculum tertium vulgo vocant, quæ et "ipſa cum plena ſint ômnia nihil eſt niſi contiguorum thalamo- "rum limes." Haller.

THE

THE third ventricle opens forward and upwards into the two lateral ventricles, and under the common communication it opens into the infundibulum. Backwards it is continued by a canal which paſſes under the tubercula quadrigemina, or nates and teſtes, into the fourth ventricle. The bottom of the third ventricle is cloſed by a ſmall ſtratum of cineritious matter, *cloiſon pulpeuſe du troiſieme ventricule*; this fills up the ſpace betwixt the junction of the optic nerves and the anterior commiſſure. We ſee it when diſſecting the baſe of the brain. Lifting the optic nerves, we ſhall find it ſtrengthened by the pia mater, and conſiſting of ſtriæ which paſs obliquely backwards and downwards, and ſome of which, while they adhere to the optic nerves, paſs into them.

As we have found that the pia mater could be traced into the lateral ventricles, and as by tearing with the probe the connections of thoſe membranes we could penetrate into the lateral ventricle without piercing the ſubſtance of the brain; ſo here we can penetrate into the third ventricle, which is deepeſt of all; and alſo into the fourth, without lacerating the ſubſtance of the brain. Thus, after raiſing the vaſcular membrane of the baſe, we can paſs a probe under the corpus calloſum backwards into the third ventricle, and by raiſing the cerebellum from the medulla oblongata, and ſeparating the adheſions of the pia mater, we get acceſs to the fourth ventricle. We conclude then, that the ventricles are not formed, as we ſhould at firſt conceive, in the ſubſtance of the brain, but that they are formed by the replication and foldings of the convolutions of the brain.

Plan of the Inflections of the Pia Mater.



See foot Note.

OF THE INFUNDIBULUM.

As I have explained in my tables of the brain, there is much confufion regarding the terms vulva and anus. Vulva is the fpace by which the three ventricles communicate, as feen when the fornix is lifted, viz. betwixt

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EXPLANATION OF THE PLATE.

1. The pia mater defcending betwixt the hemifpheres to the corpus callofum.
2. Betwixt the pofterior lobe of the cerebrum and the cerebellum.
3. Under the fornix in form of the velum.
4. Into the inferior horn of the lateral ventricle.
5. Into the bottom of the fourth ventricle.

the

the thalami nervorum opticorum and before the commiſſura mollis. The anus is behind this commiſſure, and near the nates and teſtes; both theſe are mentioned as communications betwixt the ventricles: but we know that the union of the plexus choroides, of the two lateral ventricles, and of the termination of the velum under the anterior part of the fornix, leaves the vulva free. But the velum ſpreading over the thalami, and under the poſterior part of the fornix, cloſes up the anus; and it appears as a communication ſimilar to the other only when the velum is torn up.

If we paſs a probe gently downwards and forwards from the vulva or foramen commune anterius, or communication betwixt the ventricles, we paſs it into the infundibulum. The INFUNDIBULUM is a funnel of a ſoft cineritious matter, which leads from the bottom and fore-part of the third ventricle towards the glandula pituitaria, which is ſeated in the ſella turcica of the ſphenoid bone.

The infundibulum is formed of cineritious matter, which is continued from the bottom of the third ventricle, and which adheres to the back part of the optic nerves; or, according to Warthon, of an external membrane with cineritious matter internally. Its cavity becomes contracted before it reaches the glandula pituitaria. Whether it be really capable of conveying the fluids of the ventricles, or whether it be actually pervious, is likely to remain a diſputed point. Tarin, and M. Adolphus Murray, and Haller, believe with the older writers that it is pervious. Sommerring and Vicq d'Azyr have in their experiments found it ſhut *. But to the opinion that the infundibulum conveyed the ſuperfluous moiſture from the ventricles †, it did not ſeem neceſſary to Vieuſſens that we ſhould find it to have a cavity

* "Sed non ad apicem uſque pervium." Soemmerring.

† "Structura, ſituque infundibuli ſpectatis, connexionis, & ſocietatis, quam cum cerebro, et glandula pituitaria habet, rationibus æquo judicio perpenſis, unicum illius uſum eſſe, ut aquoſum, "ſeu

cavity in all its length. He conceived that where the apparent cavity terminated, lefs vifible pores were continued towards the gland.

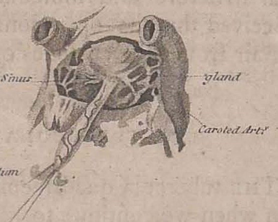
" feu lymphaticum quemdaèm cerebro depluentem humorem, majoris, " ad inftar vafis lymphatici excipiat et pituitariam verfus glandulam " fenfim tranfmittat, non autumare non poffumus : Etenim eum inter- " textarum plexibus choroidæis glandularum ufus fit, ut fanguinis " calvariam fubeuntis, fpiritufque animalis materiam fuppeditantis, " aquofiorem partem, definentibus in ipfas ab arteriis depofitum ex- " cipiant, quæ deinceps per infenfiles rariffimæ, qua obducuntur, " membranæ poros, fenfim transfluit, et partim per vulvam partimve " per axum, in tertium cerebri ventriculum delabitur; nullus effe " videtur ambigendi locus, quin aquofus omnis humore glandulis, quæ " plexuum choroidæorum vafis interferuntur, fenfim affluens, ad in- " fundibulum deferatur." Vieuffens, p. 50. Such was the opinion regarding the œconomy of the brain, and now we have no theory, good or bad, nor any explanation of this connection of the gland with the ventricles of the brain to offer.

INFUN-

INFUNDIBULUM AND PITUITARY GLAND.

Gland and Infundibulum taken out.

Pituitary Gland Seated in the Sella Turcica.



What is called the PITUITARY GLAND is a reddiſh body of a glandular-like ſtructure *, which is ſeated in the ſella turcica of the ſphenoid bone. It is plain upon its upper ſurface, or rather perhaps a little hollowed, of a globular ſhape below, and having a diviſion into two lobes. The infundibulum terminates in it, piercing the dura mater, a thin lamina of which ſpreads over the gland. The gland, as is ſeen in the above plate, lies ſurrounded with the circular ſinus, and has the cavernous ſinus upon the ſides; into theſe laſt, veſſels have been ſeen to paſs from the gland †, which, as Soemmerring obſerves, were probably veins. A diſtinction of ſubſtance has been obſerved in this gland, and it is by ſome conſidered as a part of the brain, or being like the cineritious ſubſtance, it has been ſuppoſed that it gave nerves to the fifth or ſixth pair.

It was conceived that the body receiving the ſuperflu-

* It perhaps has only the form of a gland. Haller ſays " non " acinoſa quidam, neque nullius alterius glandulæ ſimiles, quæ po- " tius cerebri quedam ſit appendix." See alſo Bordeu, Recherch. Anatomiq. ſur les Glands. Pituet Glandulæ Vitium, Sandift. Theſ. Vol. III.

† Adolph. Murray de Infundib.

ous

ous moiſture of the brain, conveyed it into the noſe; or into the neighbouring ſinuſes *. To countenance this opinion, there was no want of caſes proving the accumulation of the fluids of the ventricles, in conſequence of the ſchirrus of this gland †, while in truth diſſection has ſhewn no connection betwixt the diſeaſes of the ventricles and pituitary gland. M. Littre gave both a vaſcular ſtructure and muſcular fibres to this body, and conceived that its operations brought down the water and air from the ventricles of the brain ‡.

THE TUBERCULA QUADRIGEMINA.

The tubercula quadrigemina, or nates and teſtes, are ſeen when we continue to lift back the poſterior part of the fornix and corpus calloſum, and when we have lifted back the velum with the vena Galeni. We find, in doing this, that the velum is connected with the pineal gland, which is ſeated upon theſe tubercles. The tubercula quadrigemina are not in the cavities or ventricles of the brain, but are ſeen upon lifting and turning forward the poſterior lobes of the cerebrum from the cerebellum.

Theſe four tubercles are behind the third ventricle, and above the fourth. As they are immediately in the centre of the brain, they form a kind of commiſſure, and they both communicate with the tubercles, from which the tractus opticus emerge. The uppermoſt two are the NATES, the lower are the TESTES; the former are leſs white than the latter. A little under the inferior tubercle, we find ſometimes a ſmall tract of medullary matter, which extends to the thalami nervorum optico-

* Lower, Tract. de Corde.

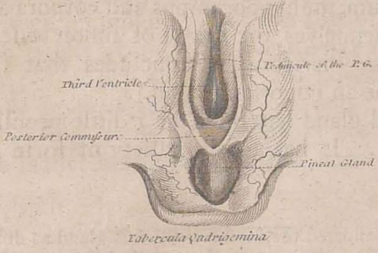
† Schneider (de Catarch.) firſt oppoſed this theory; ſhewed that there was no communication betwixt the brain and the noſe, and maintained that no fluid, not even the blood which flowed from the noſe, had any connection with the brain: he was ſupported by other able anatomiſts. The old opinion was revived by M. *Bouillet*, *Elémens de Medecine pratique*.

‡ See Littre, Mem. de l'Acad. des Sciences, 1707.

rum,

rum, and the crura cerebri. And from the lower part of the teſtes there project backwards, connecting itſelf with the crura cerebelli, a thin medullary lamina, which is the VALVULA VIEUSSENII, PROCESSUS A CEREBELLO AD TESTES, or VELUM INTERJECTUM. Behind the poſterior tubercle, or from this medullary lamina itſelf, the fourth pair of nerves take their origin. Sometimes thoſe four tubercles are of the ſame ſize; ſometimes the poſterior, ſometimes the anterior tubercles, are the larger: a perpendicular ſection of them ſhews a mutual communication of ſtriæ of medullary and cineritious matter, but thoſe are only ſeen faintly.

THE PINEAL GLAND.



THE pineal gland is ſeated above the tubercula quadrigemina, and behind the thalami nervorum opticorum; it is fixed, ſays Winſlow, like a button. It conſiſts of cineritious matter covered with the pia matter; its baſe is ſurrounded with medullary matter; it adheres firmly to the velum, and is apt to be diſplaced or torn from its pedunculi in lifting that membrane. It is a ſmall ſoft greyiſh body, irregularly round, or of the figure of a pine apple; or, of all things, likeſt the heart of

of a frog *. Its pedunculi, or footſtalks, paſs out from a tranſverſe medullary baſe, which unites it to the poſterior commiſſure. Thoſe pedunculi paſs on each ſide to the thalami nervorum opticorum (leaving a paſſage under and betwixt them to the fourth ventricle). Their extremities paſs forward upon the internal ſurface of the thalami nervorum opticorum, and are united to the anterior crura of the fornix.

Vicq d'Azyr remarks, that although the ideas of Galen and Deſcartes †, and a crowd of others are remembered only with ridicule, there are ſtill ſome peculiarities in the ſituations and connection of this body, which mark its importance. It is compoſed of cineritious ſubſtance; it is in fact a prolongation of the ſubſtance of the brain, and by its pedunculi, which are like two nerves, it is connected with the thalami nervorum opticorum, with the fornix, and conſequently with the corpus calloſum, the hyppocampus and corpora albicantia, which are themſelves the centre of union to ſeveral medullary cords; therefore he concludes that the pineal gland muſt be an important organ ‡.

The pineal gland has often in it little peculiar grains and calculi §. It has a great variety of form and ſize; I have

* Ruyſch conſidered the ſubſtance of this gland as different from that of the cerebrum or cerebellum, and different, alſo, from all other glands.

† Alluding to their opinion of this being the ſeat of the ſoul; Willis impoſed upon this part a lower office, "Ejuſque munus non "aliud omnino eſſe quam aliarum glandularum quæ juxta vaſorum "ſanguiferorum concurſus diſponuntur; nempe ut humores ſeroſos, "a ſanguine arterioſo depoſitos, excipiat, et in ſe retineat; donec "aut *venæ* depletiores factæ eoſdem reſorbeant, aut lymphæ ductus "(ſi qui adfuerint) eos extra convehant." Willis, p. 46.

‡ Mem. de l'Acad. Royal, An. 1781, p. 533. See Obſerv. par M. Mechel ſur la Gland pineal, ſur la cloiſon tranſparente, et ſur l'origine du nerf de la ſeptieme paire. L'Acad. Berlin, 1765.

§ "La parte anteriore della baſe n'è ordinari amente midollare, "e qui appunto l' ho moltiſſime volte veduta geſſata, oſſoſa, tartaroſa e friabile, vizi, che ho trovati anche molte volte nei picciuoli." Malacarne, part ii. p. 81. *Acervulus*: Meckel, Mem. de l'Acad. des Sciences a Berlin, 1755, fig. 1. b. b. Vicq d'Azyr, tab. xxvii. "Super medulloſum conarii vinculum vel in ipſo vinculo, vel in ipſo "denique

I have found it ſurrounded with pus in an ideot-boy, who was accuſtomed to wander about the Leith glaſs-houſes. He died with ſymptoms of hydrocephalus, and in his ventricles, accordingly, there was found much fluid. Malacarne gives a caſe of its having degenerated into hydatids, like a cluſter of grapes; I have alſo ſeen this appearance. It has not been found upon diſſection in ſome caſes.

POSTERIOR COMMISSURE.

The baſe of the pineal gland is connected with the poſterior commiſſure of the brain. This commiſſure is ſeen like a cord, or like the anterior commiſſure, towards the back part of the third ventricle, before the tubercula quadrigemina, and above the iter ad quartum ventriculum. Betwixt this commiſſure and the baſe of the pineal gland, we have to obſerve two or three medullary filaments, not paſſing from the gland, but lying parallel to the commiſſure. But this part of the brain, which appears like a cord, does not deſerve the name of commiſſure; it does not paſs on each ſide into the ſubſtance of the brain as the anterior one does; it is loſt in the neighbouring border of medullary matter, and is merely this matter reflected, ſo as to have a rounded edge.

CEREBELLUM.

The cerebellum lies under the poſterior part of the cerebrum. It weighs about a ſixth or ſeventh part leſs than the cerebrum; it lodges in that part of the baſe of the cranium which belongs to the occipital bone, and has the tentorium ſtretched over it: and it is divided into two great lateral portions by the ſpine of the os occipitis and the falx cerebelli.

" denique acervulo, plerumque vero ante acervulum iam in fetibus " inmaturis peculiares quidam lapilli, mox maiorum acervulum, mox " vero duo vel tres minores acervulos conſtituentes, helui, ſemiperlu- " cidi, iunioribus ſemper pallidiores, annoſioribus fuſciores, infanti- " bus ob coloris languorem et perluciditatem difficiles cognitu ſiccati " albidiores et opaciores inveniuntur." Soemmerring, p. 63.

The

The cineritious matter of the cerebellum is external, like that of the great mafs of the cerebrum; but the medullary internal matter prefents an appearance fomewhat different, for on a fection being made it appears branching like a tree, and has been called *arbor vitæ*.

The concentration of the medullary matter, from the two fides of the cerebellum, towards the nodus cerebri, form what are called the crura cerebelli.

OF THE FOURTH VENTRICLE.

THE fourth ventricle defcends perpendicularly before the cerebellum; it is inclofed above by the valvula cerebri, below by the medulla fpinalis, and on the right and left by the crura cerebelli.

When, from the third ventricle, we pafs our probe obliquely backwards and downwards under the pofterior commiffure, it paffes into the ITER AD QUARTUM VENTRICULUM, or AQUEDUCT of SILVIUS. This paffage to the fourth ventricle, goes before the tubercula quadrigemina. The VALVULA VIEUSSENII, it was fuppofed, prevented the falling down of the moifture of the other cavities into the fourth ventricle *: it is more properly called the PROCESSUS CEREBELLI AD TESTES, being a medullary lamina fpread over the ventricle and betwixt the crura cerebelli, as they rife from the ARBOR VITÆ, or the internal medullary part of the cerebellum.

From the aqueduct there is continued down upon the fore-part of the fourth ventricle a kind of fiffure; which Vefalius, conceiving it to have fome refemblance to a writing quill, called CALAMUS SCRIPTORIUS. The fame fiffure or furrow is continued down fome way upon the fpinal marrow.

There pafs up obliquely outwards, on each fide of the calamus fcriptorius, medullary lines, three or four in number, but fometimes feven are obferved †. One of thefe fibres afcends to the valvula Vieuffenii; fome

* Alveus Silvii.

† Haller, Phyfiol. tom. iv. p. 78.

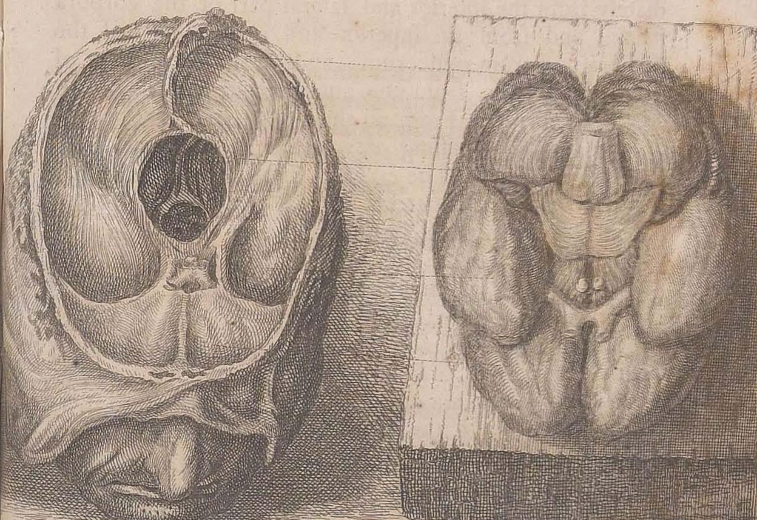
are

are the origines of the auditory nerve, and one or two ſtriæ go to form part of the eighth.

In the fourth ventricle, as in the others, are ſome convolutions of the plexus choroides; theſe are on each ſide at the termination of the vermis; they are continued out upon the baſe of the brain, and are ſeen expoſed betwixt the ſeventh and eighth pair of nerves.

OF THE BASE OF THE BRAIN AND ORIGIN OF THE NERVES.

Relation of the Brain & Scullcap.



We have anticipated much that might have fallen to be treated of in this diviſion of our ſubject; but my intention here is to give a connected view of the parts, as ſeen when we have raiſed the brain from the ſcull, and when, having the baſe preſented to us, we are about to enumerate the origins of the nerves.

The firſt appearance which ſtrikes us is the great proportion of the medullary matter in the baſe of the brain; the whole ſurface of the brain, while ſeen from above,

was cineritious, but now the central medullary part of the brain is ſeen emerging from the envelopement of the cineritious matter, and, gathering together from the ſeveral internal medullary proceſſes of the brain, it concentrates the eſſential properties of the encephalon, and is fitted to give out the ſeveral nerves. Thoſe great medullary prolongations of the cerebrum and cerebellum are called the crura.

The CRURA CEREBRI are compoſed of a white fibrous medullary matter, in which alſo there is a mixture of cineritious ſubſtance. They are formed from the whole central medullary part of the cerebrum; or more immediately from the inferior and lateral part of the corpora ſtriata, and from the ſuperior and internal part of the thalami nervorum opticorum; and, from the conflux of medullary matter, from the anterior and poſterior lobes of the cerebrum. From all theſe various parts the medullary matter, paſſing downwards and backwards, forms the crura *. The crus of either ſide of the brain, contracting their diameters, unite at an acute angle, and are united to the pons Varolii, or nodus cerebri, formed by the crura cerebelli; they paſs on to form the medulla oblongata, and, as they unite with it, they raiſe it into the eminences, called Corpora Pyramidalia. In thoſe proceſſes of the cerebrum, the cineritious and medullary ſubſtances mingle with ſome degree of confuſion; ſo that when we make a ſection of the crura cerebri near to their union with the pons varolii, we obſerve a ſubſtance of a dark-brown colour, ſurrounded with white or medullary matter. In the angle of the union of theſe crura cerebri, behind the corpora albicantia, and before the protuberance of the pons varolii, we obſerve a matter leſs perfectly white than the ſurrounding medullary ſubſtance, which forms a floor to the third ventricle. This part is perforated with a great many holes, and is the *ſubſtance perforée* of Vicq d'Azyr †, and gives origin to

* I ſpeak ſtill of the relation of thoſe to each other, according to their natural ſituation in the ſcull.

† Vicq d'Azyr makes three diviſions of this *ſubſtance perforée*—1ſt. At the roots of the tubercles, from whence the firſt pair of nerves

to the third pair of nerves along with the crura themſelves.

CRURA CEREBELLI.

THE crura cerebelli are more expoſed than thoſe of the cerebrum; the latter lying deeper, and being comparatively ſmaller. They are formed by the union of the internal medullary part of the cerebellum, or the arbor vitæ. They are altogether compoſed of medullary matter, except near the pons varolii, where we obſerve a mixture of coloured ſtriæ.

PONS VAROLII.

THE PONS VAROLII, TUBER ANNULARE, OR NODUS CEREBRI is formed by the union of the crura cerebri and cerebelli; thoſe names are almoſt deſcriptive of its ſhape and relation to the other parts. Varolius, looking upon thoſe parts inverted, compares the crura cerebri to a river paſſing under a bridge, and thence named it Pons. The nodus cerebri, again, is a name well applied, ſince this medullary eminence has much the appearance of a knot caſt upon the medullary proceſſes of the cerebrum, and is in fact the central union of the elongated medullary matter of both cerebrum and cerebellum.

On the ſurface of this medullary protuberance there are many tranſverſe fibres, which, uniting in a middle line, form a kind of rapha, which, upon a ſuperficial ſection, ſhews a longitudinal medullary line. The fibres upon the ſurface of this body are uniform and parallel to each other in the moſt projecting part; but upon the ſides, they diſperſe to give place to the fifth pair of nerves and crura cerebelli.

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nerves emerge betwixt the roots of thoſe nerves, and near the origin of the optic nerves. 2d. Thoſe I mention betwixt the crura cerebri. 3d. On the outer contour of the optic thalami.

A deeper incifion of the pons varolii, while it fhews the intimate union of the crura cerebri, cerebelli, and pons varolii, alfo fhews the white medullary tracts which extend from the crura cerebri through the pons varolii to the corpora pyramidalia; part of thefe pafs through the LOCUS NIGER CRURUM CEREBRI, and can be traced to the corpora ftriata. We fee alfo the tranfverfe fibres of the medullary and cineritious fubftance, which make a right angle with thofe longitudinal tracts.

Anatomifts have fought to explain a very curious phenomenon by fuppofing that there is a decuffation of the nervous filaments at this part. It has often happened that an injury to the one fide of the brain, an ulcer or tumor on one fide, caufed a lofs of power in the oppofite fide of the body *, and the lateft authority we have † proves that a tumor on the one fide of the pons varolii, will produce an effect on the other fide of the body. But no decuffation can be obferved; fibres, as I have faid, run acrofs like commiffures, but the tract of matter is direct not oblique.

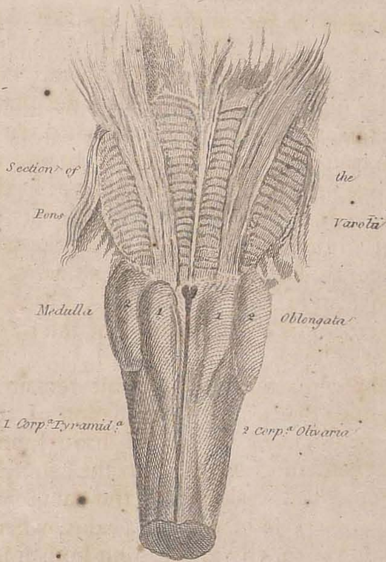
I am tempted to think there muft remain much obfcurity on this fubject of the decuffation of the fibres of the brain, or origin of nerves. I have found that the effect is not conftant. An ulcer in the hemifphere of the cerebrum produced weaknefs in the fame fide; and in one well marked cafe of hydrocephalus, when the brain on diffection was equally affected on both fides, the one fide of the body was convulfed and drawn up, and the other fide motionlefs. This is not a fingular occurrence; I have feen the eyes, face and tongue in perpetual motion; but the force entirely on one fide; both lateral ventricles were full of water.

* The obfervation has defcended from *Hippocrates*, and the explanation that it depends on a decuffation of the roots of the nerves is from *Aretæus*.

† Medico-Chirur. Tranfactions, VII.

MEDULLA

MEDUBLA OBLONGATA.



THE medulla oblongata is the prolongation of the ſubſtance of the crura cerebri and cerebelli, and the pons varolii; it is conſequently the continuation of the encephalon, which, after giving off the nerves that paſs through the foramina of the ſcull, enters the canal of the ſpine to ſupply the ſpinal nerves. The medulla oblongata is marked at its upper end by a deep ſulcus divid-

ing it from the pons varolii; but towards the ſpinal cavity it decreaſes in thickneſs, and there is no natural diſtinction or ſulcus to mark the point where the medulla oblongata ends, and the medulla ſpinalis begins; nor perhaps is the medulla oblongata to be conſidered in any other light than as the beginning of the ſpinal marrow. When it paſſes the foramen magnum, it ceaſes to be called the medulla oblongata.

We have to obſerve four eminences upon the medulla oblongata, viz. two corpora pyramidalia, and two corpora olivaria. The CORPORA PYRAMIDALIA, ſo called from their ſhape, are thoſe in the middle. There is formed betwixt them and the pons varolii (being three tubercles placed together) a little ſulcus, which ſome have called the FORAMEN CÆCUM. Betwixt theſe eminences there is a longitudinal fiſſure, in the bottom of which there may be obſerved tranſverſe little cords, which are like commiſſures connecting the two ſides of the medulla oblongata.

The CORPORA OLIVARIA lie upon the ſides of the corpora pyramidalia. They are in ſome degree, like them, limited by the ſulcus which bounds the pons varolii, rounded above and bulging, but gradually ſubſiding, at their lower part, into the level of the medulla ſpinalis; yet they are internally different, for anatomiſts had obſerved a mixture of a yellow or cineritious-coloured matter in the corpora olivaria, but Vicq d'Azyr has obſerved a regular oval medullary ſubſtance, or body ſurrounded with cineritious-coloured ſubſtance, like a miniature-repreſentation of the cerebrum itſelf; he calls it CORPUS DENTATUM EMINENTIÆ OLIVARIS.

MEDULLA SPINALIS.

THE medulla ſpinalis, from its ſtructure, its two ſubſtances, its membranes, and its uſe, as evident in the conſequences of injury, muſt be conſidered as an elongation of the brain. Its name implies its ſituation contained within the tube of the ſpine. Though chiefly compoſed of medullary matter, it is not entirely ſo; for there is an irregular, central, cortical ſubſtance, through

its

its whole extent, having ſomething of a crucial form in the ſection of this part *. There are continued down from the calamus ſcriptorius behind, and the rima, formed by the corpora pyramidalia, before, two fiſſures which divide the ſpinal marrow into lateral portions. On the back part, however, the fiſſure is very little diſtinguiſhable. Into the anterior one the little veſſels penetrate to ſupply the cineritious matter with blood. The two lateral portions are divided into an anterior and poſterior portion, ſo that this prolongation has four diſtinct portions. The ſpinal marrow diminiſhes in thickneſs as it deſcends in the neck; but below the giving off of the brachial plexus it again enlarges, then continues gradually to diminiſh.

The tube of the vertebræ is connected by a ſtrong ligamentous ſheath, which runs down the whole length within the tube. The dura mater, after lining the internal ſurface of the cranium, goes out by the great foramen, and forms a kind of funnel; at the occipital foramen it is united firmly to the ligament. Further down, however, it forms a ſeparate tube. The tunica arachnoides again adheres looſely, having a kind of ſecretion within it, while the pia mater cloſely embraces, and is intimately united to the medullary matter.

From betwixt the ninth nerve and vertebral artery to the ſecond and third lumbar nerve, there is a membranous connection betwixt the lateral part of the ſpinal marrow and the dura mater of the ſpine. From the manner of its connection to the dura mater, by diſtinct ſlips irregular and pointed, it is called the Ligamentum Denticulatum, or Dentatum.

SCHEME AND GENERAL DESCRIPTION OF THE ORIGINS OF THE NERVES OF THE ENCEPHALON AND SPINE.

In enumerating the nerves which paſs from the cranium, I ſhall keep to the old way of Willis, counting

* The ſurface of the ſpinal marrow has alſo been obſerved to be of a darker colour, and in large animals diſtinctly cineritious. (Dr. Monro's Nervous Syſtem.)

 only

only nine nerves of the encephalon. I do not find that the ſub-diviſions of the nerves in this claſſification, and the deſcription of the ſeveral faſciculi, of which the pairs of nerves are compoſed, cauſe intricacy. It rather, I am from experience convinced, connects ſome circumſtances with many of the pairs of nerves thus enumerated, to which the memory of the ſtudent can attach. The common enumeration ſeems a natural one; it ſerves well the purpoſe of diſſection, and conſequently will never be entirely exploded. The uſe of new claſſifications and arrangements, and names, whilſt we muſt alſo retain the old, adds much to the intricacy of demonſtration.

From the olfactory nerve to that which paſſes out betwixt the cranium and firſt vertebra, there are nine nerves *.

1ſt pair—Olfactory nerves.	*Carunculæ mamillares Math.* de Grad. *Proceſſus ad nares.* Gonth. d'Andernac. 8um par Spigel. 1ſt pair of Willis.
2d pair—Optic nerves.	*Nervus viſivus, ſeu viſorius.* Carpi. 1^{m} *par antiquorum.* 2d pair of Willis.
3d pair—Motores oculorum.	2um par Fallop. et Veſal. Nerfs moteurs communs des yeux.—Winſlow. 3d pair of Willis.
4th pair—Trochlearis.	*Minor propago* 3^{ii} *Paris, id eſt* 5^{i} *recentiorum, Fallop.* *Gracilior radix* 3^{ii} *Paris, id eſt* 5^{i} *recentiorum.* Veſal. *Nervus qui prope nates oritur.* Euſtach. 9um par Cortes: et Columb. 4th pair; or, pathetic nerves of Willis.
5th pair—Trigemini.	*Nervous anonymus trigeminus multorum.* 3um par Fallop. et Veſal. 5th pair of Willis. Trijumeaux of Winſlow.

* In the following table I am indebted to the ſynonymie of Vicq d'Azyr.

6th pair—Abductores.		4um par Fallop. *Radix gracilior* 5^{i} *Paris, id eſt* 7^{i} *recentiorum Veſal.* *Par oculis proſpiciens.* 8um par Capp. Bauhini. 6th pair of Willis. Nerfs oculo-muſculaires, ou moteurs externes de Winſlow.
7th pair	Auditory nerves.	2um par Alexand. Benedict. 4um par Carol. Stephan. 5um par Veſal. et aliorum. 6um par V. Horne. Portia mollis, of the Moderns.
	Nervus communicans faciei.	*Diſtinctus a molli nervus.* Fallop. *Portio ut præcedens* 5^{i} *Paris, id eſt* 7^{i} *recentiorum.* Veſal. Portio dura, of the Moderns. Le petit ſympathique, of Winſlow. Facial nerve.
8th pair	Gloſſo-pharyngeus.	*Qui ad muſculos linguæ et faucium tendet. Fallop.* Le rameau lingual de la 8^{e} paire of Winſlow. 8th pair d'Anderſch. Superior faſciculus of the 8th pair of Willis. *Gloſſo Pharyngeus.* Haller.
	Par vagum.	*Nervus ſextus* Galeni *et aliorum.* 5^{a} *conjugatio* Carol. Stephan. 7um par Alex. Benedict. 6um par Caſp. Bauhini. 9um par Bidloo et Anderſch. 8th pair of Willis. Lè moyen ſympathique of Winſlow.
	Spinal acceſſory nerve.	The ſpinal nerve.
9th pair—Lingual.		7um par Fallop. Veſal *et aliorum.* 11um par Bidloo. 10um par Anderſch. *Par linguale medium, vel nervus lingualis medius.*—Haller. Soemmerring *et aliorum.* The hypogloſſal, *ſub-lingual,* or guſtatory. The 9th pair of Willis.
10th pair—Sub-occipital nerve.		10th pair of Willis. 1ſt ſpinal, or cervical nerve, of Haller. I count this the firſt cervical nerve.

FIRST

FIRST PAIR; OR, OLFACTORY NERVES *.

THE olfactory nerve is soft and pulpy, and soon resolved by putrefaction; therefore, we should not be surprised that it was neglected by the ancients †. It adheres firmly to the lower surface of the anterior lobe of the brain, but it does not take its origin here. It is of a triangular shape, as if moulded to the sulcus in which it lies; by being sometimes sunk into the sulcus more or less on one side than the other, it has the appearance of being larger on one side than the other. It takes its origin by three medullary tracts ‡; 1st, From the corpus striatum; 2d, From the medullary matter of the anterior lobe; 3d, From the fore and under part of the corpus callosum §. When a section is made of it, we observe in it a cineritious portion.

Towards the fore-part, this nerve expands into a bulbous oval lobe, which consists of a semi-transparent cineritious substance. This lies upon the cribriform plate, and from it are sent down the nerves which ex-

* In the present enumeration and description of the nerves, we attend chiefly to their relation to the brain. In the introduction to the next part of this volume, they will be found arranged and classed previous to the detail of their minute distribution.

† The olfactory nerve is in brutes a large prolongation of the substance of the brain, and is the proper mamillary processes. Their olfactory nerves have a cavity or ventricle in them, and it was natural for the ancients to imagine that the pituita of the brain was from this strained through the cribriform plate into the nose. Vesalius proved the absurdity of this opinion; it was, however, revived by Dulaurens, who was perhaps more of a courtier than an anatomist. But Willis is not much better, when he describes the proper use of these nerves. He supposed the cribiform plate of the æthmoid bone to prevent bodies from passing up into the brain ("ne quid asperi aut "molesti cum illis una ad cerebrum feratur"); while the lymph in those nerves corrected the too pungent odours; "odorum species "demulcere, easque sensorio quadantenus præparare."

‡ Or we say that the external root generally splits, having two fasciculi. See Prochaska, tab. 1. Scarpa, Annot. Anat. p. 106.

§ Vicq d'Azyr, M. de l'Acad. Roy. 1781.—"Breviores fibræ "medulloræ cum longioribus exterioribus connexæ nonnunquam "cineream particulam excipiunt." Soemmerring.

pand

pand upon the membrane of the nofe, and compofe the organ of fmelling *.

SECOND PAIR; OR, OPTIC NERVES †.

The optic nerves arife from the pofterior part of the optic thalami, whilft they have a connection with the tubercula quadrigemina. When we trace the optic nerves backwards into the tractus opticus, we find them taking a circle round the crura cerebri, then enlarging, each forms a tubercle towards the back part of the thalamus opticus, and afterwards unites with the pofterior tubercle of the thalamus opticus; at the fame time a divifion ftretches towards the teftes, while betwixt the pofterior tubercle of the thalamus opticus and the nates, there is an intermediate communication. When thofe tubercles are fairly expofed by feparating the middle lobes of the brain, and diffecting away the tunica arachnoides and pia mater, they are feen fmooth, and formed of medullary matter; which is uniformly continued from the one to the other, following their gentle convexities with an uninterrupted furface. Within thofe tubercles is a mixture of cineritious and medullary matter, and, efpecially, there is a diftinct ftreak which paffes from the tractus opticus to the nates ‡.

Thus there is a communication betwixt the nates and teftes, and the optic nerve; but we muft ftill confider the nerve as arifing in a peculiar manner from the thalamus opticus, while at the fame time it adheres to the crus cerebri.

Tracing the optic nerves from their origin in the brain towards their exit from the fcull, we find them

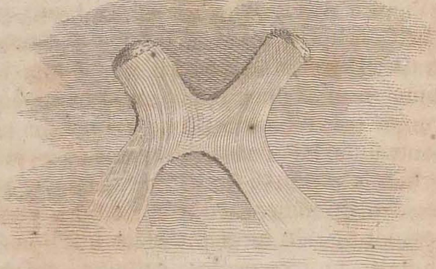
* Duverney has fhewn us, that thofe nerves paffing through the cribriform plate become firm nerves, like thofe in the other parts of the body. They are to be feen by tearing the membrane of the nofe from the bone.

† The optic nerves were the firft pair of Galen and many of the older anatomifts, they being ignorant of the olfactory nerves.

‡ Santorini tab. Scarpa Anatom. Annotat. p. 106.

approaching

approaching gradually and uniting just before the corpora albicantia and the infundibulum.



Section of the Union of the Optic Nerve.

Since the days of Galen, it has been a disputed point, whether there is a union simply of the nerves, or a decussation. Fishes have the nerve arising from one side of the brain passing to the eye of the other side: they cross, but they do not unite. Birds have but one optic nerve arising from the brain, which splits and forms the right and left optic nerves. Vesalius dissected a young man at Padua, who had lost his eye a year before; at the same time he dissected a woman, whose eye had been lost a long while. In the latter he found the nerve of that side smaller, firmer, and of reddish colour, through all its extent. In the young man he observed no effect upon the nerve. He also gives a plate of an instance in which he found the optic nerves pass on to the eyes of the same side from which they take their origin, without adhering at all.

Valverda, a physician of Spain, who travelled into Italy, and studied the works of Vesalius and Human Dissection, says, that at Venice he had frequent opportunities of assuring himself that there was no decussation;

for

for robbers were puniſhed for the firſt offence by loſing one of their eyes; and for the ſecond by death. Riolinus, Rolefinkius, and Santorini, give obſervations of the nerve of the injured eye being ſmall and ſhrivelled, and of their having traced them paſt their union to the ſame ſide of the brain with the eye to which they belonged. Vicq d'Azyr, who, of all authors I conceive to be the beſt authority upon ſuch ſubjects, is decidedly of opinion that there is no decuſſation. Zin alſo agrees with the opinion of Galen, that there is an adheſion and intimate union of ſubſtance, but no croſſing of the nerves. Soemmerring deems it ſufficient to point out the authorities on both ſides of the queſtion, while he has no decided opinion whether there be a perfect decuſſation or not *. Porterfield, while he allows the intimate union of the optic nerves, has ſeveral obſervations, proving that they have no interſection or decuſſation.

Sabatier, encouraged by the authority of Morgagni, ſays, that he could trace the affection of the nerve of the injured eye no farther than to the union. He diſcredits the accounts of their having been traced to the ſame ſide of the brain, and believes the aſſertions to be the conſequence of previous opinion and prejudice.—There are certain obſervations of Valſalva, Cheſelden, and Petit, which ſeem to prove, that where the brain is injured, it is the eye of the oppoſite ſide that is affected †. After their union the optic nerves are much contracted in diameter; ſtill the optic nerve is the largeſt of the head, excepting the fifth pair. It is the firmeſt of all the nerves of the ſenſes, but ſofter than the other nerves ‡.

What remains to be ſaid of the optic nerves, falls

* "Ergo, utrum omnes nervorum fibræ, an qædam tantum mutuo "ſe ſecent, certe ſtatui nequit."

† If Petit and others are proving that the optic nerves are affected in the ſide oppoſite to the injury of the brain, they are proving that they have no decuſſation; for if they had, it would counteract that effect, which, from the ſtructure of the brain, they muſt have in common with the other nerves.

‡ Soemmerring.

more naturally to be treated of when ſpeaking of the organ of viſion.

THIRD PAIR OF NERVES; MOTORES OCULORUM.

THE third pair of nerves ariſe from the internal margin of the crura cerebri, and the perforated medullary matter which is betwixt the crura. The delicate filaments of this nerve cannot be traced far into the ſubſtance of the brain, but ſtill we may obſerve them ſpreading their filaments, and traverſing the dark-coloured ſpot which we have already mentioned to be viſible in the crura cerebri. Some anatomiſts have ſaid, that the third pair of nerves had an origin alſo from the nates and teſtes. Ridley deſcribes them as riſing from the pons varolii *.

In relation to the arteries, thoſe nerves are betwixt the poſterior artery of the cerebrum, ariſing from the diviſion of the baſilar artery and the anterior artery of the cerebellum †. They diverge from each other as they proceed forwards, and each penetrates under the anterior point of the tentorium by the ſide of the cavernous ſinus; and paſſes through the foramen lacerum. In the general deſcription it is ſufficient to ſay, that they are diſtributed in common to all the muſcles of the eye.

THE FOURTH PAIR OF NERVES.

THE fourth pair of nerves, pathetici, or trochleares, are the ſmalleſt nerves of the encephalon, being not much larger than a ſewing thread. This nerve comes out from betwixt the cerebrum and cerebellum, paſſes by the ſide of the pons varolii, and after a long courſe

* They ſeem to come from the angle betwixt the crura cerebri and pons varolii. They are flat near their origin, but become round and firm.

† " Cette diſpoſition peut expliquer pourquoi on éprouve tant de " péſanteur aux yeux aux approches du ſommeil, dans l'ivreſſe & " dans certains eſpeces de fievre." Sabatier. This is a mechanical and a moſt improbable way of accounting for ſuch an effect.

pierces the dura mater behind the clynoid proceſs, runs along for ſome way in a canal or ſheath, formed by the dura mater; it then paſſes through the cavernous ſinus, continues its courſe onwards through the foramen lacerum to the orbit, and is finally appropriated to the ſuperior oblique muſcle of the eye.

The origin of the fourth pair, if we take implicitly the deſcriptions of authors, ſeems to have a much greater variety than any of the other nerves; ſo that it is common to ſay, the fourth pair of nerves ariſe about the region of the nates and teſtes *. The trochlearis ariſes ſometimes by two filaments, but more commonly by one undivided root †. This root is ſeen to emerge from a point betwixt the medullary lamina of the cerebellum, or valvula Vieuſſenii, and the lower part of the tubercula quadrigemina ‡.

From the connections of the parts whence this nerve ariſes with the reſt of the brain, it is preſumed, that this fourth pair of nerves has a very immediate and univerſal connection with the internal parts of the brain; yet there is nothing in the final diſtribution of the nerve, which ſhould incline us to believe that there ſhould be any particular proviſion in its origins.

* "" Pone corpora bigemina poſteriora mox paullo ſuperius, " mox paullo inferius, mox magis exteriora, mox magis interiora " verſus radice ſimplici, duplici, triplici, quin et quadruplici oritur. " —Nonnunquam origo ejus in cerebri valvula, nonnunquam in ipſo " frenulo patet ut humore ventriculi quarti alluatur." Soemmerring, vol. iv. p. 209.

† Santorini ſays, they have three roots or little faſciculi. Wriſberg following Vieuſſens, ſays, the fourth pair ariſes from the valvula cerebri. Vicq d'Azyr. See Haller, faſ. vii. tab. 3. " Origo " alius ſimplex eſt, alius duplex; quando ſimplex eſt, a proceſſu a " cerebello ad teſtes exterius prodit, quam eſt tranſverſa ſtria, quæ " eos proceſſus conjungit." Haller Phyſ. vol. iv. p. 208.

‡ " Et ſouvent ils ſe confondent avec un tractus medullaire placé " tranſverſalement au-deſſus de la valvule du cerveau." Vicq d'Azyr. This nerve, ſays he, cannot be followed into the anterior part of the brain from its extreme delicacy, and becauſe it is formed from the medullary ſubſtance itſelf, without the admixture of filaments to give it ſtrength. He quotes thoſe words of Soemmerring: " Con- " tinua medulla oritur."

FIFTH

FIFTH PAIR OF NERVES; TRIGEMINI.

The fifth nerve of the brain arifes from the fore and loweft part of the crura cerebelli, where they unite with the pons varolii. The origin of this nerve may be divided into two portions: an anterior is fmall, and fomewhat elevated above the other. The pofterior part of this origin takes its rife a little lower than the anterior part. Thefe two origins of the nerve are connected by a cellular membrane, and have betwixt them a little groove, in which not unfrequently an artery creeps. According to Santorini, the anterior of thefe divifions is formed by the tranfverfe fibres of the pons varolii, and the pofterior by the crura cerebelli *. Vicq d'Azyr could never, except in one diffection, perceive that any of its fibres arofe from the pons varolii †. The nerve of the right fide has been obferved fometimes larger than that of the left.

This fifth nerve, the largeft of the fcull, paffing forwards and downwards, flips in betwixt the lamina of the dura mater, oppofite to the point of the pars petrofum of the temporal bone. It is here firmly attached to the dura mater, and forms a flat irregular plexus. From this plexus there pafs out three great branches:—1ft, One to the focket of the eye and forehead, through the foramen lacerum; 2d, One to the upper jaw and face, through the foramen rotundum; and 3d, One to the lower jaw and tongue, paffing through the foramen ovale.

SIXTH PAIR OF NERVES; OR, ABDUCENTES ‡.

The fixth nerve of the fcull feems to arife from betwixt the pons varolii and medulla oblongata. In the

* Santorinus. Wrifberg de quinto p. Nervor. Scarpa Anat. Annotat. p. 107.

† "Oritur e nodo cerebri, prope cerebellum duabus partibus, &c." Soemmerring.

‡ Or, motores externi.

origin

origin of its fibres it has, however, much variety; and authors differ very much in this point of the deſcription *. We may ſay, however, that the ſixth pair of nerves ariſe from the corpora pyramidalia.—Sometimes the nerve riſes in two branches, which do not unite until they are entering into the cavernous ſinus †. The ſixth nerve is in ſize ſomewhat betwixt the third and fourth: it paſſes forward under the pons Varolii, until near the lateral and lower part of the body of the ſphenoid bone: it thence continues its route forwards and downwards by the ſide of the carotid artery, through the cavernous ſinus: here it ſeems increaſed in ſize.—It gives off that ſmall twig which anatomiſts account the beginning of the great ſympathetic nerve. The ſixth nerve, after giving off this delicate thread, paſſes on through the foramen lacerum to the abductor muſcle of the eye.

SEVENTH PAIR OF NERVES; OR, AUDITORY.

THE ſeventh nerve ariſes from the poſterior and lateral part of the pons Varolii, at the point where it is joined by the crura cerebelli.

But this ſeventh pair of Willis conſiſts of two parts; the facial nerve or portio dura, and the auditory or portio mollis; the laſt is the larger and poſterior portion ‡.

The PORTIO DURA comes out from the foſſa formed betwixt the pons varolii, corpora olivaria, and crura cerebelli §; and upon a more careful examination we find it riſing diſtinctly from the crus cerebelli.

The origin of the portio mollis, of the ſeventh pair, is to be traced from the fore-part of the fourth ven-

* Simple as the anatomy of the nerve is, Vieuſſens, Morgagni, Lieutaud, Winſlow, Sabatier—all differ in their account of the origin of this nerve in ſome little circumſtance; and Vicq d'Azyr gives ſix varieties of it.

† Sabatier. Scarpa loc. cit.

‡ And we may add a third portion; the portio media of Wriſberg.

§ "Foſſe de l'eminence olivare," of Vicq d'Azyr.

 tricle,

tricle*. We obferve paffing obliquely upwards from the calamus fcriptorius feveral medullary ftriæ; thofe vary in number from two to feven, and are fometimes not to be difcerned†. To thefe are added certain fibres arifing from the pons Varolii, and as thefe fibres proceed from their origin, they become ftill more diftinctly formed into fafciculi. The whole of this portio mollis is larger than the third nerve, firmer than the firft, but lefs fo than the fecond pair; it forms a kind of groove which receives the portio dura. The portio mollis and portio dura entering the meatus auditorius internus of the petrous bone, the former is divided into four portions which pafs to the feveral parts of the internal ear. The latter paffes through the ear, and comes out by the ftylo-maftoid foramen behind the ear, fpreads upon the cheek, and forms the principal nerve of the face.

EIGHTH PAIR OF NERVES.

To underftand a very intricate demonftration, it is neceffary to recollect that the eighth pair of nerves, as they have a relation to the brain, confifts of three diftinct nerves.—Thefe are, 1ft, The GLOSSO-PHARYNGEAL NERVE; 2d, The PAR VAGUM; 3d, The SPINAL ACCESSORY.—Taken all together, they arife from the fuperior and lateral part of the medulla oblongata.

* Prochafka, fpeaking of the fourth ventricle, continues thus:—"Super has ultimas eminentias folent medullares candicantes quafi "fibræ decurrere, a quibus proprie originem portionis mollis ner"vorum auditoriorum faltem pro parte deducunt." (Ridley, Haller, Lobftein, cum per antiquo auctore Piccolhomini et etiam recentiffimus Soemmerring.—"Ego poftquam multoties in lineas illas "medullares in quarto ventriculo inquifiviffem, dicere poffum, non "femper illas in originem nervi acuftici mollis terminare; nonnun"quam enim paulo fupra nonnunquam paulo infra definunt, ali"quando in uno latere, & haud raro utrinque defiderantur, ita ut "ex his obfervationibus perfuadear illas medullares quarti ventri"culi ftrias ad originem portionis mollis nervi acuftici minime effen"tiales effe." Prochafka, tab. iii. f. f. Scarp. loc. cit.

† It is a curious circumftance, fhould future obfervation confirm it, which has been mentioned by Santorini, that thofe origins of the auditory nerve have been obferved particularly ftrong in a blind man, whofe hearing had been very acute.

The

The GLOSSO-PHARYNGEAL NERVE is only diſtinguiſhed within the ſcull as a larger filament of the eighth pair; it is however diſtinct in its courſe from the origin to the point where it pierces the dura mater: it is the uppermoſt of the fibres of this pair of nerves.—Sometimes there is a very delicate filament running parallel with its lower edge which belongs to it. It has the ſame origin with the fibres of the par vagum *.

The PAR VAGUM is compoſed of ten or twelve very ſmall filaments, which are ſometimes united into three or four faſciculi. Theſe filaments ariſe from the outer border of the corpus olivare, or from the lateral part of the medulla oblongata †. Sometimes they ariſe in a double ſeries like the nerves of the ſpine: a few fibres are to be traced from the ſide of the calamus ſcriptorius of the fourth ventricle.

The SPINAL ACCESSORY NERVE comes up from the ſpine to join the par vagum; it begins by ſmall twigs from the poſterior roots of the fourth, fifth, ſixth, and even the ſeventh cervical nerves. In the ſize, length, and origin of thoſe little ſlips, there is much variety: as the nerve aſcends to the top of the ſpine, it connects itſelf with the ſub-occipital nerve; it then paſſes behind the trunk of the vertebral artery, approaches the par vagum, and receives ſome filaments from the medulla oblongata.—Thoſe three nerves, the gloſſo-pharyngeal, par vagum, and acceſſory nerves, in their paſſage out of the ſcull are connected in a very intricate way ‡. They there ſeparate from each other. The anterior branch, the gloſſo-

* "Nervus gloſſo-pharyngeus faſciculo mox una, mox duabus, "quatuor, quinque fibris compoſito oritur ex ſumma atque priore "parte medullæ pone corpora olivaria nervum facialem inter atque "nervum vagum, nonnunquam etiam ex quarto ventriculo vel ex "cruribus cerebelli ad ſpinæ medullam, nonnunquam ſub poſteriori "ſulco nervi vagi, deductus ab eo vel diſtinctius, vel obſcurius in-"terpoſita arteria, vel vena, vel arteria et vena ſimul, vel parte "plexus choroidis, quid quod ipſa directione a nervo vago eſt di-"ſtinctus." Soemmering.

† Some filaments, according to Vieuſſens, Santorini, and Soemmerring, are derived from the paries of the 4th ventricle.

‡ The minutiæ of which will afterwards call for attention.

gloſſo-pharyngeal nerve goes to the tongue and pharynx; the middle nerve, the par vagum, has an extenſive courſe through the body, and finally terminates in the ſtomach; the loweſt nerve, the acceſſory, paſſing into the neck, perforates the maſtoid muſcle, and diſtributes its branches amongſt the muſcles of the ſhoulder.

NINTH PAIR OF NERVES; OR, LINGUAL.

THE ninth nerve of the ſcull originates from betwixt the corpora pyramidalia, and olivaria. Like all the nerves of the ſpine, it is compoſed of ſeveral little filaments; thoſe unite into a faſciculus of a pyramidal ſhape: ſtill thoſe filaments do not form a nerve before perforating the dura mater, but pierce it ſeverally *; they then unite and paſs out of the ſcull by the condyloyd foramen of the occipital bone; they are then connected with the eighth pair and ganglion of the ſympathetic nerve.—The final diſtribution of the nerve, is to the muſcles of the tongue †.

THE TENTH; OR SUB-OCCIPITAL NERVE.

FROM its origin, its manner of paſſing betwixt the ſcull and firſt vertebræ, and its diſtribution, it muſt be claſſed with the nerves of the ſpine.

The nerves of the ſpine are divided into the eight cervical, twelve dorſal, five lumbar, five, and ſometimes ſix or ſeven, ſacral nerves ‡. Each of thoſe twenty-five

* The ninth pair of nerves often differ very much in one ſide from the other, in regard to the origin and number of thoſe faſciculi.

Scarpa, after ſhewing that moſt of the nerves have double origin, deſcribes this alſo riſing in two parts. Anat. Annotat. p. 108.

† "Forſan etiam nimio ſanguine plena arteria vertebrali preſſus "læditur, ut inde hæſitantia atque reſolutio linguæ ebriorum, ex cerebri phlegmone inſanientium, attonitorum explicari poſſit.—Collapſa vero eadem arteria ex nimio ſanguinis profluvio lingua ob ſanguinis forſan defectum reſolvitur.—Ex ejuſdem nervi nexu cum nervis cervicalibus vocis jacturam poſt læſam ſpinalis medullæ partem "quæ in cervice eſt, explicarunt."

‡ "Plerumque quinque ſunt, nonnunquam ſex, raro tres vel quatuor." Soemmerring.

nerves

nerves ariſes in two faſciculi, one from the fore, and the other from the back part of the ſpinal marrow. They are to be traced a great way in the length of the ſpinal marrow before they paſs the membranes. The poſterior and anterior faſciculi penetrate the dura mater ſeparately, and afterwards unite. The poſterior faſciculi of the the dorſal nerve before they unite with the other, ſwell into a little ganglion. The poſterior faſciculi of the cervical nerves communicate with each other by intermediate filaments.

CHAP. IV.

OF THE PARTICULAR NERVES.

THE FIRST PAIR OF NERVES; OR, OLFACTORY NERVES.

WE have deſcribed the three roots of this pair of nerves: their triangular form, their bulbous extremities, and their manner of perforating the cribriform plate of the æthmoid bone.

Where the ſoft and pulpy-like maſs of the olfactory nerves perforates the æthmoid bone, the dura mater involves them, and gives them firm coats *. There are two ſets of nerves thus formed. Firſt, thoſe which paſs through the holes in the cribriform plate, neareſt the criſta galli, run down upon the ſeptum of the noſe, under the ſchneiderian membrane, and betwixt it and the perioſteum; they become extremely minute as they deſcend; and they, finally, paſs into the ſoft ſubſtance of the membrane.

* Duverney firſt obſerved this courſe and firmneſs of the olfactory nerves.

 The

The ſecond claſs of filaments are thoſe which paſs down by the outer ſet of holes of the æthmoid plate, and which are diſtributed to the membrane inveſting the ſpongy bones.

Although branches of the ophthalmic, pterigoid, palatine, and ſub-orbital nerves paſs to the membrane of the noſe, there is reaſon to believe that they have no power of conveying the impreſſion of odours. Theſe nerves are neceſſary that the membrane may poſſeſs the common properties beſtowed by the nerves.

Upon the queſtion, whether thoſe additional branches of nerves to the noſe, aſſiſt in conveying the impreſſion of odours, there has been much controverſy. It is a ſubject upon which we might reaſon by analogy; but, certainly, little dependence can be placed upon thoſe caſes brought by either party, of diſeaſes affecting the one ſet of nerves without influencing the other. From the nature of the parts, ulceration or tumors, which deſtroy the bones of the noſe, muſt preſs equally upon the branches of the olfactory nerve, and of the fifth pair. We find that there paſs alſo to the other organs of ſenſe, ſubordinate nerves; and we know that a nerve may be modified to much variety of function; and this is evident from the nerve of taſte being a branch of the fifth pair. But it is doubtful how far a nerve may be capable of receiving at one inſtant various impreſſions. Far from conſidering diſtinct nerves ſent to the ſame organ, as affording an argument for theſe nerves receiving one uniform impreſſion, and conveying one ſimple ſenſation, it would ſeem more rational to infer, that one individual nerve cannot perform two functions, and that two functions are often required in the organs of ſenſe. I am inclined to believe, that the olfactory nerve is incapable of beſtowing common ſenſation on the membrane of the noſe; and that the other nerves which ramify on that membrane, do, on the other hand, contribute nothing to the ſenſe of ſmell, as we find that the inflammation of the pituitary membrane, which raiſes the ſenſibility of the branches of the fifth pair of nerves, does in no degree make thoſe of the olfactory nerve

leſs

leſs acute. The membrane is painfully inflamed, but the ſenſe of ſmell is deadened. In attending to the delicate ſenſibility of the nerves of the ſenſes, we neglect to take into account the leſs prominent, but no leſs curious peculiarities in the ſenſations, and ſympathies of the common nerves. The ſenſes of taſte or ſmell are not more diſtinct from each other, or from common ſenſation, than are the peculiar ſenſations which belong to the ſenſibility of the ſeveral viſcera. The ſtomach and inteſtinal canal poſſeſs as great a diſcriminating power as the organ of taſte, although the ſenſations are leſs perfectly conveyed to the ſenſorium. There is a variety in the ſuſceptibility of the ſeveral organs and viſcera, a diſtinct ſenſation and proportioned action and election which is eſſential to the order and œconomy of the general ſyſtem. This is conſpicuous in the variety of the affections in remote parts, when food, medicine, or poiſon is received into the body. Theſe peculiarities in the impreſſion of which each organ is ſuſceptible, are ſo far diſtinct as to be eſſential to the due excitement of that organ; and are yet ſo general, as to connect, in one combined action, the whole ſyſtem, and to occaſion ſympathies in remote parts, which perplex us, and give that degree of intricacy to the living actions, which renders medicine an uncertain art.

ARRANGEMENT OF THE NERVES PROCEEDING FROM THE CRANIUM.

The firſt nerve we have ſeen paſſing to the noſe.

The ſecond, third, fourth, part of the fifth and ſixth, paſs to the eye, or through the orbit.

The ſeventh nerve is that which becomes the organ of hearing.

Part of the fifth, ſeventh, eighth, ninth, and ſub-occipital nerves paſs to the bones of the face, the integuments and muſcles of the face, the jaw, and throat.

From the ſixth pair of nerves is derived the great ſympathetic; from the eighth is ſent downwards the par vagum.

 The

The extreme branches of the fifth pair, of the ſeventh, of the eighth, ninth, and firſt cervical nerves, form a chain of connections, ſurrounding the head, face, and neck.

SECOND PAIR; OR OPTIC NERVES.

IN this part of the work there is no occaſion to deliver any thing further concerning the optic nerves, than has been already ſaid of their origin, and final expanſion in the retina of the eye. It will be more proper to conſider them fully when treating of the eye in particular.

THIRD PAIR OF NERVES; OR MOTORES OCULORUM.

THESE nerves have the name of motores oculorum, becauſe they are diſtributed to the muſcles which move the eye-balls. They paſs upwards from their origin; and then diverging, they penetrate the dura mater under the extreme point of the tentorium; they deſcend again by the ſide of the cavernous ſinus; and paſs out of the cranium by the foramen lacerum of the ſphenoid bone.

The nervus motor oculi having come into the ſocket divides into two branches: The INFERIOR BRANCH paſſes forward along the outſide of the optic nerve; it then divides into theſe branches:

1. To the adductor muſcle.
2. To the rectus inferior.
3. To the external oblique and to the lenticular ganglion.

But the branch of the third nerve, which, with the fifth, forms this little ganglion, is, by no means, conſtantly derived from this branch. The LESSER and SUPERIOR BRANCH of the third, is diſtributed to the rectus ſuperior oculi and levator palpebræ ſuperioris.

FOURTH PAIR OF NERVES, TROCHLEARES; OR PATHETICI.

THESE nerves are very ſmall. Their origin, from about the tubercula quadrigemina, and their long courſe under the baſe of the brain, have been already deſcribed; after proceeding a conſiderable way, incaſed in the duplicature of the dura mater, where it forms the extreme point of the tentorium, they paſs amongſt the lamellæ of the dura mater, where it forms the cavernous ſinus. They paſs by the outſide of the third pair of nerves; turn round ſo as to be above them, and make their egreſs through the foramen lacerum of the ſphenoid bone. They paſs forward in the orbit, undiminiſhed by the giving off of branches; and are each finally diſtributed to the ſuperior oblique muſcle or trochlearis. Sometimes, however, in their courſe, they ſend branches to unite with thoſe of the fifth pair, which paſs to the noſe, or even to the frontal nerve; but this is very rare *.

As this nerve is derived very far back from the brain, and as the parts from which it originates are leſs affected by the diſtention of the ventricles than almoſt any other part of the brain, this has been given as a reaſon why in hydrocephalus we ſo frequently ſee the eyes turned obliquely towards the noſe. The origins of theſe nerves being leſs affected, they will give a comparatively greater power to the ſuperior oblique muſcle. It has been obſerved alſo, that in death the power of the ſuperior oblique muſcle is greater than the other muſcles of the eyeball. I account differently for theſe phenomena.

THE FIFTH PAIR, OR TRIGEMINI.

THE tracing of the branches of the fifth pair, by diſſection, is a difficult taſk, for thoſe branches are diſtributed among the bones of the face, to the eyes, noſe, mouth, tongue, and throat. From this extenſive diſtri-

* Soemmerring.

bution

bution the fifth nerve is neceſſarily the largeſt of thoſe that paſs out of the cranium.

It is of a flattened form *; it penetrates the dura mater at the anterior point of the petrous bone, and ſpreads flat under it. Here, under the dura mater, it is matted into one irregular ganglion; *viz.* the ſemilunar, or Gaſſerian ganglion. This ganglion lies on the anterior point of the temporal, and on the ſphenoidal bone. In their paſſage from the brain, the filaments, compoſing the fifth nerve, are looſe, or eaſily ſeparated; at this place, they are all found ſo ſubdivided and entangled, as to reſiſt further diviſion. The nerve here ſwells out into a greater ſize; it ſeems to be incorporated with the denſe fibres of the dura mater; it becomes of a dark-red, or mixed colour; all which circumſtances have, by no means, been unobſerved by anatomiſts. Vieuſſens ſuppoſed, that the uſe of this ganglion, of the fifth pair, before it perforates the cranium, was to ſtrengthen the nerve, and enable it to withſtand the motion of the jaws! But it would rather ſeem to be a ganglion connecting in ſympathy all thoſe parts to which the nerve is finally diſtributed †.

The connection of the Gaſſerian ganglion with the dura mater, is ſo firm, that it yet remains undecided, whether there are ſent off here any nerves to that membrane; but I conceive, that there are none, and that the connection of the ganglion with the fibrous membrane, or ſheath which covers it, has been miſtaken for nerves paſſing from the ganglion to the dura mater.

From the ſemilunar or Gaſſerian ganglion, the fifth nerve divides into three great branches; whence the name of trigeminus:

1ſt, The OPHTHALMIC BRANCH of WILLIS, which paſſes through the foramen lacerum into the orbit.

2d, The SUPERIOR MAXILLARY NERVE, which paſſes through the foramen rotundum.

* So it is ſaid, by Miekel, to reſemble the flat worm, or tænia.

† "Et affectum animi indicia in faciei partibus depingere adjuvet." Hirſch. Sand. Theſ. Diſerta. p. 491.

3d, The INFERIOR MAXILLARY NERVE, which paſſes to the lower jaw, through the foramen ovale.

The ophthalmic branch of the fifth pair.

This nerve enters the orbit in three diviſions; theſe are, the *frontal*, the *naſal*, and the *lachrymal* nerves.

1ſt, The firſt of theſe runs under the perioſteum of the upper part of the orbit, and above the levator palpebræ ſuperioris. Upon entering the orbit it gives off a ſmall branch, which paſſes to the frontal ſinus; the nerve then divides into the ſuper-trochlearis, and the proper frontal nerve. The firſt of theſe paſſes to the inner part of the orbicularis oculi and frontal muſcle. The other, the outermoſt, and the proper frontal nerve, paſſes through the hole, or notch, in the margin of the orbit, and mounts upon the muſcles and teguments of the forehead. Theſe ſuperficial branches communicate with the extreme branches of the portio dura, or nervus communicans faciei.

Caſes are on record of wounds of the frontal nerve occaſioning a great variety of nervous ſymptoms, and eſpecially loſs of ſight; and it certainly marks a very particular connection and ſympathy betwixt this branch and the common nerves which paſs to the eye-ball and iris, and the retina, that blindneſs is actually occaſioned by the pricking of the frontal nerve. Morgagni ſuppoſes this to be occaſioned by the ſpaſmodic action of the recti muſcles preſſing the globe of the eye down againſt the optic nerve. It is alſo remarkable, that impreſſions acting ſolely on the retina, will convulſe the muſcles of the eye, give them irregular contractions, and conſequently diſtort the eye-ball and produce blindneſs. Such has been found to be the effect of lightning in ſome inſtances.

2d, The NASAL BRANCH of the ophthalmic nerve ſends off a ſlip or twig to form with a branch of the third pair, the LENTICULAR or OPHTHALMIC GANGLION; while the trunk of the nerve paſſes obliquely forwards, and inward through the orbit, and gives off one

one or two extremely ſmall twigs, which join the faſciculi of ciliary nerves. The naſal branch then continues its courſe betwixt the ſuperior oblique and adductor muſcles; before piercing the orbital plate, it ſends forward a branch, which paſſing under the pulley of the ſuperior oblique muſcle, joins that diviſion of the frontal nerve which paſſes over the pulley. The naſal nerve then paſſing through the internal orbital foramen, enters the ſcull again, and runs under the dura mater, which covers the æthmoid bone, to paſs through the cribriform plate of that bone, and again to eſcape from the cranium. It is finally diſtributed to the upper ſpongy bones, and to the frontal ſinuſes.

We thus obſerve ſuch a connection of the nerves of the eye and noſe, and of thoſe diſtributed to the inner angle of the eye, and muſcles of the eye-lids, as ſufficiently accounts for the ſympathy exiſting among thoſe parts. We ſee the neceſſity of this connection, ſince the excitement of the glands which ſecrete the tears, the action of the muſcles, and the abſorption of the tears into the noſe, muſt conſtitute one action.

The LENTICULAR, OR, OPHTHALMIC GANGLION, comes naturally to be conſidered under this diviſion of the fifth pair. The lenticular ganglion is formed by a twig from the naſal branch of the fifth pair, after being united to that branch of the third pair of nerves, which goes to the levator palpebræ and the rectus ſuperior muſcles. The ganglion is of a ſquare form, and is ſituated upon the outſide of the optic nerve. The ciliary nerves paſs out from this ganglion in two faſciculi; they are ten or twelve in number; they are joined by branches of the continued naſal nerve. The ciliary nerves run forward amongſt the fat of the orbit, to the ſclerotic coat of the eye, and pierce it very obliquely in conjunction with the ciliary arteries. The ciliary nerves and arteries then paſs forward betwixt the ſclerotic and choroid coats of the eye to the iris. The iris is conſidered as the part the moſt plentifully ſupplied with nerves (as it certainly is alſo with arteries) of any part in the body.

It

It follows, indeed, from what we formerly ſaid, that a profuſe circulation of blood is neceſſary to an accumulated nervous power.

From the connection of theſe ciliary nerves with thoſe paſſing to the noſe, Soemmerring accounts for ſneezing being the conſequence of a ſtrong light upon the eye. This may perhaps be true; but, certainly, the temporary loſs of light, from ſneezing, does not depend upon this connection of the nerves, but upon the immediate affection of the optic nerve and retina, from the concuſſion and interruption to the circulation, or upon the accumulation of blood in the eye.

2. The LACHRYMAL NERVE is the leaſt of the three diviſions of the ophthalmic nerve; it divides into ſeveral branches before it enters the gland. Several of theſe branches paſs on to the tunica conjunctiva, being joined by twigs of the firſt branch of the ſuperior maxillary nerve. Others connect themſelves with the extremities of the portio dura of the ſeventh pair, and with the ſuperior maxillary nerves.

THE SECOND BRANCH OF THE FIFTH PAIR; VIZ. THE SUPERIOR MAXILLARY NERVE.

THE ſuperior maxillary nerve, having paſſed the foramen rotundum, emerges behind the antrum highmorianum, at the back part of the orbit, at the root of the pterigoid proceſs of the ſphenoid bone. The infra-orbital canal lies directly oppoſite, and ready to receive one branch, while the ſpheno-maxillary, opening into the orbit, is above, ready to receive another. The chief part, or trunk, of the nerve may be ſaid to be ſeated, and to give out its diviſions in the pterigo-palatine foſſa. Through the ſpheno-maxillary hole, the firſt branch of the ſuperior nerve is ſent into the ſocket of the eye. This twig unites with branches of the lachrymal nerve, and in general ſupplies the perioſteum of the orbit. It then ſends, through the foramen in the os malæ, a branch which is diſtributed to the orbicularis muſcle of the

the eye-lid, and communicates with the branches of the portio dura of the ſeventh pair, or nervus communicans faciei. Another branch of this firſt diviſion paſſes upward from the zygomatic foſſa, in a groove of the wing of the ſphenoid bone, to the temporal muſcle, and getting ſuperficial, it accompanies the branches of the temporal artery.

Independently of this branch, which paſſes upwards to the temporal muſcle, Miekel, in his firſt diſſertation on this nerve, divides its branches into four: 1ſt, The infra orbital; 2d, The deſcending branch, which again gives off the vidian and naſal nerves; 3d, The palatine nerve and poſterior alveolar nerve. It was not till afterwards that he diſcovered the ganglion which takes his name; and, of courſe, the previous deſcription muſt be imperfect. The ſuperior maxillary nerve, after ſending off the ſmall branches which I have deſcribed to enter the orbit, having fairly emerged out of the cranium, ſends down two ſmall branches which, uniting, form a ſmall ganglion of a rediſh colour, and of a triangular ſhape, like a heart. This, the SPHENO-PALATINE GANGLION, or ganglion of Miekel, is exactly oppoſite to the ſpheno-palatine hole; and thoſe nerves, and this ganglion are immerſed in the ſoft fat which fills up the ſpace betwixt the ſphenoid palatine and ſuperior maxillary bones.

From this ganglion are ſent out ſeveral leſſer nerves, and particularly the naſal, vidian, and palatine nerves.

The SUPERIOR NASAL BRANCHES paſs to the membrane on the back part of the noſe, and to the cells of the ſphenoid bone.

The VIDIAN NERVE comes off from the back part of the ganglion, and paſſes into the foramen pterigoideum backwards. It firſt gives off ſome ſmall branches to the noſe (the ſuperior and poſterior naſal nerves of Miekel); theſe perforating the bone laterally, are diſtributed on the pituitary membrane, covering the vomer. The vidian nerve continuing its courſe backwards, ſplits; one branch, after a long retrograde courſe through the petrous

petrous part of the temporal bone, forms a connection with the portio dura, while the other forms one of the roots of the great ſympathetic nerve, by joining the branch of the ſixth pair, which paſſes down with the carotid artery.

From the diſtribution of this branch of the fifth pair to the membrane of the noſe, and its connection with the ſympathetic, ſome phyſiologiſts account for the effects of odours in cauſing fainting, as the chief nerves of the heart are received from the ſympathetic. They alſo account thus for the excitement of the heart, in deliquium, by ſtimulant applications to the noſe.

The PALATINE NERVE is the largeſt of the branches ſent out from the ganglion. We have to recollect, that there are two canals in the bone conveying nerves to the palate; one anterior and larger; and another running nearly parallel to it, a poſterior and ſmaller one. The diviſion of the palatine nerve, which deſcends through the anterior palatine hole, is of courſe the larger branch; as it paſſes through the canal, it gives branches which enter the noſe, to be diſtributed upon the pituitary membrane. This larger branch, in its further progreſs through the bone, divides, and having emerged from its hole, is diſtributed all along on the ſoft palate. The poſterior diviſion of the palatine branch, paſſing down, by the poſterior palatine foramen, is diſtributed to the velum pendulum palati and its muſcles.

There is yet a third branch of the palatine nerve; viz. the external palatine nerve. It is the leaſt of all the branches; and, ſometimes, inſtead of coming from the ganglion, is derived immediately from the ſuperior maxillary nerve. This branch deſcends before the pterigoid proceſſes, and on the convex ſurface of the upper maxillary bone, and is diſtributed to the velum palati and uvula.

The ſuperior maxillary nerve, after ſending off the branches which form the ſpheno-palatine ganglion, paſſes obliquely downward to the infra orbital canal. In this courſe it gives off the poſterior nerve to the teeth

teeth of the upper jaw; and this again gives off a twig, which takes a courſe on the outſide of the maxillary bone, and ſupplies the gums and alveoli, and buccinator muſcle.

While paſſing in its canal, the infra-orbital nerve gives off the anterior nerve to the teeth; and when it emerges from the infra-orbital foramen, it ſpreads widely to the muſcles of the face, connecting itſelf with the extremities of the portio dura of the ſeventh pair or nervus communicans faciei.

The "tic douloureux," and the "tic convulſif," of the French authors, are diſeaſes attributed to the affection of this nerve. The ſeat of the tic douloureux is the ſide of the face, the noſtril, the cheek-bone, and root of the alveoli. Sauvage calls it the triſmus dolorificus, or maxillaris. But it is a diſeaſe not abſolutely fixed to this point of the cheek-bone; but on the contrary, from the univerſal connection betwixt the nerves of the face, it takes, ſometimes, a wide range; and the diſeaſe, I have no doubt, is ſometimes ſeated in the portio dura of the ſeventh pair. Sauvage has given to one ſpecies of it, the name of occipitalis.

It is a diſeaſe attended with extreme pain, which forces the patient to cry out in great agony. The pain is felt deep rooted in the bones of the face, and ſeems to ſpread upon the expanded extremities of the nerve; it is ſudden, violent, and reiterated in its attack, and it varies in the length and repetition of its acceſſion. It is confined chiefly to thoſe advanced in years, and is as violent in the day as during the night; and in the advanced ſtate of the diſeaſe, when the face is ſwelled, the ſlighteſt touch will excite the pain.

This diſeaſe is apt to be confounded with the affection of the antrum highmorianum, the tooth-ach, rheumatiſm, and clavis hyſtericus, or even with venereal pains. It has been cured by dividing the infra-orbital nerve, but this is an uncertain remedy.

In hemicrania, the affection of the three branches of the fifth nerve, is ſuch as to mark their diſtributions. There

There is ſwelling and pain of the face, pain of the upper maxillary bone, pains in the ear and in the teeth, difficulty of ſwallowing, and laſtly, ſtiffneſs in moving the lower jaw, in conſequence of the affection of thoſe branches which paſs up to the temporal muſcle.

There are caſes ſpoken of by Sabatier, where this infra-orbital nerve being wounded, unuſual nervous affections, and even death, were the conſequence: but it would rather appear, that, independently altogether of the affection of the nerves of the face, inflammation ſpreading from the wound to the brain, had, in the examples which he gives, been the occaſion of the unuſual ſymptoms, and of the death of the patients.

THIRD BRANCH OF THE FIFTH PAIR; OR, LOWER MAXILLARY NERVE.

THIS, the laſt of the three great diviſions of the fifth pair of nerves, the largeſt but the ſhorteſt branch within the ſcull, paſſes out by the foramen ovale. It is diſtributed to the muſcles of the lower jaw, tongue, and glands. The trunk of the nerve having eſcaped from the cranium, lies covered by the external pterigoid muſcle; and is at this point divided into two great branches, which again ſubdivide into numerous ſmall branches; many of which it would be ſuperfluous to deſcribe. It is ſufficient to mention them as going, 1, to the maſſeter muſcle; 2, to the zygomatic foſſa and temporal muſcles; 3, to the buccinator muſcle.

We regard as the two greater diviſions of this nerve, the proper maxillary nerve which paſſes into the lower jaw; and the guſtatory or lingual nerve; the diviſion into theſe two great branches is formed, after the nerve has paſſed the pterigoid muſcles.

The GUSTATORY NERVE, immediately after its ſeparation from the nerve of the lower jaw, is joined by the chorda tympani; or, perhaps we ſhould rather ſay, a branch of this nerve, by traverſing the petrous portion of the temporal bone in a retrograde direction,

 unites

unites itſelf with the portio dura of the ſeventh pair, as it is paſſing through the ear. This nerve being ſeen paſſing acroſs the tympanum, is the reaſon of its being called CHORDA TYMPANI. The guſtatory nerve, proceeding obliquely downward, ſends off twigs to the ſalivary glands and muſcles, ſituated betwixt the jaw-bone and tongue. Where it is paſſing by the ſide of the maxillary gland, it gives out ſome filaments which form a ſmall ganglion, from which branches penetrate the gland. The trunk then proceeding onward betwixt the ſub-lingual gland and the muſculus hyo-gloſſus, ſeveral twigs are ſent off, which form a kind of plexus amongſt the muſcles and ſalivary glands; and communicating with the ninth pair of nerves, are diſtributed, finally, to the gums and membrane of the mouth.

The guſtatory nerve terminates in a laſh of nerves, which ſink deep into the ſubſtance of the tongue, betwixt the inſertion of the ſtylo and genio-gloſſal muſcles. Theſe paſs to the papillæ on the ſurface of the tongue. The ſenſe of taſte, the impreſſion of which is received upon this nerve, is ſeated in the edge and anterior part of the tongue: the action of the tongue againſt the palate forces the ſapid juice of the morſel to extend to the edge of the tongue.

The proper lower maxillary nerve, which enters into the lower jaw-bone, ſometimes called *mandibulo labralis*, paſſes downward in an oblique direction to the groove of the lower jaw-bone. Before this nerve enters the canal of the bone, it gives off branches to the mylo-hyoideus and digaſtricus, to the ſub-maxillary glands and to the fat. The nerve then entering the bone, runs its courſe all the length of the lower jaw within the bone, and comes out at the mental hole. In this courſe it gives branches which enter the roots of the teeth, and accompany the branches of the arteries. When this lower maxillary nerve has eſcaped from the mental hole, it divides into two branches upon the chin; one of theſe is diſtributed to the orbicularis and depreſſor anguli oris,

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and to the ſkin and glands of the lips; the other to the depreſſor labii inferioris and integuments, and forms a kind of plexus, which ſurrounds the lips. Theſe nerves are alſo connected with the wide-ſpreading branches of the portio dura of the ſeventh pair; and they are the loweſt branches of the facial nerves, and the laſt enumerated of the intricate branches of the fifth pair.

THE SIXTH PAIR OF NERVES; ABDUCENTES, OR MOTORES EXTERNI.

THE ſixth pair of nerves, as we have ſeen, ariſes betwixt the tuber annulare and the corpus pyramidale. Advancing forwards and upwards, ſometimes above and ſometimes beneath the branches of the baſilar artery, it penetrates the dura mater by the ſide of the baſilar ſinuſes. It then paſſes by the ſide of the carotid artery, and through the cavernous ſinus. Here it gives off filaments, which, clinging to the carotid artery, deſcend with it until they are joined by a branch of the vidian nerve. Theſe together form the origin of the great ſympathetic nerve. It is a diſputed point, however, whether this be a branch given out from, or received into, the ſixth pair; and in the deſcription of the ſixth pair, we might ſay, with equal ſhow of reaſon, that as it paſſes the carotid artery, it receives one or more nerves which come up through the carotid hole, and encircle the nerve. The ſixth pair enters the orbit by the foramen lacerum, with the third and fourth pairs, and firſt branch of the fifth. It pierces the abductor muſcle of the eye before it is finally diſtributed to its ſubſtance.

It has been preſumed, that the ſixth nerve does not give off the ſympathetic nerve, but receives thoſe branches from it, becauſe the ſixth nerve is larger betwixt this point and its diſtribution in the orbit, than betwixt the ſame point and its origin from the brain. But I conceive, that this enlargement of the ſixth pair is not owing to, ſuch a junction; but that, on the contrary,

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trary, the nerve naturally ſwells out when it enters the ſinus, not from being ſoaked in the blood of the ſinus, but from its having additional inveſting coats, or from the coats being ſtrengthened in order to prepare the nerve for its paſſage through the blood of the ſinus.

Again, that the ſympathetic nerve ſends up thoſe branches to join the ſixth, has been preſumed from the effects of experiments on brutes in which the ſympathetic nerve has been cut or bruiſed. But I ſhould not be apt to give implicit credit to the reſult of theſe experiments. Suppoſing that the ſympathetic in the neck gave an origin to the ſixth pair, ſhould not paralyſis of the abductor muſcle of the eye, and in conſequence of this, the turning of the eye towards the noſe, be the effect of cutting the ſympathetic? On the contrary, inflammation and heavineſs of the eye has been obſerved.

We ſhall probably ceaſe to diſpute this point, when we conſider the relations and uſe of the ſympathetic nerve.

The ſympathetic nerve may be defined, a tract of medullary matter, paſſing through and connecting the head and neck, the viſcera of the thorax, abdomen, and pelvis, into one whole. The ſympathetic nerve is ſingular in this, that it takes no particular origin, but has innumerable origins, and a univerſal connection with the other nerves through all the trunks of the body. Thoſe viſcera to which it is diſtributed are entirely independent of the will, and have functions to perform too eſſential to life to be left under the influence of the will. The ſympathetic nerve is thus, as it were, a ſyſtem within itſelf, having operations to perform of which the mind is never conſcious; whilſt the extent of its connections occaſion, during diſeaſe, ſympathetic affections not eaſily traced.

It is impoſſible ſeriouſly to conſider the ſixth nerve as giving the origin to the ſympathetic in any other light, than as ſuch an expreſſion may be ſubſervient to arrangement, deſcription, and general enumeration of the

the nerves;—a thing moſt neceſſary in ſo intricate a piece of anatomy.

OF THE SEVENTH PAIR OF NERVES.

THE nerves of the ſeventh pair conſiſt each of two faſciculi, which ariſe together, and paſs into the foramen auditorius internus *. But theſe portions do not paſs through the bone in union; for the anterior and leſſer faſciculus, is a common nerve, which paſſes through to the face, and is inveſted, like the common nerves of the body, with ſtrong coats. It is therefore called the PORTIO DURA †. The more poſterior faſciculus is the auditory nerve, and is diſtributed to the organ within the pars petroſa of the temporal bone; and in diſtinction it is called the PORTIO MOLLIS.

The PORTIO DURA, or NERVUS COMMUNICANS FACIEI, in paſſing from the brain to the internal auditory foramen, is lodged in the fore-part of the auditory nerve, as in a groove. When it leaves the auditory nerve, it paſſes on through the bone, and emerges on the ſide of the face through the ſtylo-maſtoid foramen at the root of the ſtyloid proceſs, ſo as to come out betwixt the lower jaw and the ear, covered, of courſe, by the parotid gland. The portio dura, while paſſing through the canal of the temporal bone (which is the aqueduct of Fallopius), gives off a branch which unites with the vidian nerve of the fifth pair; or rather, we may conclude with the beſt authors, that it receives a branch which comes retrograde from the vidian nerve, paſſing through the ſmall hole on the anterior ſurface of the petrous part of the temporal bone. The portio dura, when it has proceeded onwards by the ſide of the tympanum, gives off one or more very minute branches to

* The intermediate filaments of Wriſberg, which is betwixt theſe two portions of the ſeventh nerve, is afterwards united to the portio dura, and muſt be conſidered as one of its roots.

† Galen divided all the nerves of the brain into thoſe two claſſes, *mollis* and *dura*; of which the firſt were thoſe of the ſenſes, the latter the motores corporis.

the muſcles within the tympanum, which give tenſion to the ſmall bones of the ear. A little further on, this nerve gives off a more remarkable branch, which, paſſing acroſs the tympanum, is called CORDA TYMPANI. This is the branch which, as we formerly mentioned, joins the guſtatory branch of the lower maxillary nerve. The corda tympani paſſes through the tympanum betwixt the long proceſs of the incus and the handle of the maleus; then, received into a groove of the bone, it paſſes by the ſide of the Euſtachian tube, and after enlarging conſiderably, it is united with the guſtatory nerve.

When the portio dura, or nervus communicans faciei, has eſcaped from the ſtylo-maſtoid foramen, but is yet behind the condyle of the lower jaw, and under the parotid gland, it gives off, 1ſt, The poſterior auris. This has connection with the firſt cervical nerve, and paſſing up behind the ear, it is connected with the occipital branches of the third cervical nerve. 2d, The nervus ſtylo-hyoideus to the ſtyloid muſcles, and to unite with the ſympathetic. 3d, A branch which ſupplies ſome of the deep muſcles, and joins the laryngeal branch of the eighth pair.

The portio dura, riſing through the parotid gland, ſpreads out in three great diviſions:

1. An ASCENDING BRANCH, which divides into three temporal or jugal nerves; ſo called, becauſe they aſcend upon the jugum, or zygomatic proceſs. Two orbitary nerves, which, paſſing up to the orbicularis muſcle, branch upon it, and inoſculate with the extremities of the fifth pair.

2. The FACIAL NERVES. The ſuperior facial nerve paſſes out from the upper part of the parotid gland, acroſs the face to the cheek and orbicularis muſcle of the eye. The middle facial nerve paſſes from under the riſorius Santorini; it goes under the zygomatic muſcle, and encircles the facial vein; it ſends branches forward to the lips, and upwards to the eye-lids, and to unite with the infra-orbital nerve. There is an inferior facial nerve,

nerve, which comes out from the lower part of the parotid gland, paſſes over the angle of the jaw, and is diſtributed to thoſe fibres of the platyſma myoides which ſtretch up upon the face, and to the riſorius Santorini: it paſſes on to the angle of the lips, and is diſtributed to their depreſſor muſcle. Betwixt thoſe facial nerves there are frequent communications, while they are at the ſame time united with the extremities of ſeveral branches of the fifth pair.

3. The DESCENDING BRANCHES paſs along the margin of the jaw, down upon the neck, and backward upon the occiput. Thus we ſee that the communicating nerve of the face is well named.—It is diſtributed to the ſide of the face, head, and upper part of the neck: it unites its extreme branches with thoſe of the three great diviſions of the fifth pair, with the eighth and ninth, with the acceſſory of the eighth pair, with the ſecond and third cervical nerves, and with the ſympathetic. From thoſe various connections it has been called the leſſer ſympathetic. As to the ſympathies which phyſicians have thought fit to aſcribe to the connections of this with other nerves, as in laughing, weeping, kiſſing, &c. they would be tedious to enumerate, and by no means inſtructive.

The PORTIO MOLLIS of the ſeventh pair of nerves is the acuſtic or auditory nerve; which ſhall be conſidered in a more diſtinct and particular manner, when we deſcribe the other parts of the organ of hearing.

The nerves which we have now deſcribed are connected with the anatomy of the head, and circulate chiefly around the bones of the face. Thoſe we are next to conſider extend their branches to the neck, and form there a very intricate piece of anatomy, while a claſs of them ſtill more important, paſs down to the viſcera of the breaſt and belly.

THE EIGHTH PAIR OF NERVES.

THE faſciculus, which, proceeding from the medulla oblongata, paſſes out of the cranium by the ſide of the

 great

great lateral ſinus, and which, in the view we have of the nerves upon raiſing the brain from the cranium, is properly enough conſidered as the eighth pair, conſiſts in truth of three diſtinct nerves. Theſe are the GLOSSO-PHARYNGEAL NERVE, the PAR VAGUM, and the SPINAL ACCESSORY NERVE OF WILLIS.

THE GLOSSO-PHARYNGEAL NERVE.

THIS nerve, parting from its connection with the par vagum and acceſſory nerves, perforates the dura mater ſeparately from theſe, and in many ſubjects, paſſes through an oſſeous canal diſtinct from the par vagum. When it eſcapes from the cranium, it lies deep under the angle of the jaw, and paſſes acroſs the internal carotid artery upon its outer ſide. It is to be ſeen by lifting the ſtyloid muſcles, at which point it ſends ſmall branches to the ſtyloid and digaſtric muſcles, and to join the par vagum. It ſends alſo ſome very ſmall twigs down upon the internal carotid artery; ſome of which join that pharyngeal branch * which is formed from the par vagum and acceſſory nerve.

Theſe branches united form a ſmall irregular ganglion, from which again paſs off numerous branches to the conſtrictor muſcles of the pharynx.

The trunk of the gloſſo-pharyngeal nerve, after giving off thoſe nerves which paſs in the direction of the internal carotid artery, continues its courſe attached to the ſtylo gloſſal and ſtylo-pharyngeal muſcles, to which of courſe it gives more branches, and alſo to the upper diviſion of the conſtrictor pharyngis. A diviſion of the extreme branches of this nerve terminates in the tongue, under the denomination of RAMI LINGUALES PROFUNDI,

* This is a branch to the pharynx which is formed by the par vagum and the ſpinal acceſſory of Willis. After this nerve is formed, it again forms connection with the par vagum.—Pain in the throat having been obſerved by Galen to extend to the back, Scarpa explains it on the ground of this connection with the ſpinal acceſſory nerve.

RAMI

RAMI LINGUALES LATERALES, NERVI GLOSSO-PHARYNGEI *.

It appears to me that theſe branches are diſtributed amongſt the ſhort muſcles of the tongue, and perhaps to the large papillæ upon the moſt poſterior part of the tongue. Amongſt the branches of the pharyngeal nerve is to be enumerated that which turns back to join the ninth pair in its diſtribution to the tongue †. The remaining branches of the gloſſo-pharyngeal nerve, are diſtributed in innumerable filaments upon the pharynx, in which they are aſſiſted by branches from the ganglion of the ſympathetic nerve.

THE PAR VAGUM.

THE par vagum is the great and important diviſion of the eighth pair. It is the middle faſciculus of the three nerves as they lie within the ſcull. In its exit, it is ſeparated from the internal jugular vein by a thin bony plate; and ſometimes two or three fibres of the nerve paſs the bone diſtinct from the others, and afterwards unite into the proper trunk of the par vagum. Deep under the lower jaw and the maſtoid proceſs, the gloſſo-pharyngeal nerve, the par vagum, the ſpinal acceſſory, the ſympathetic nerve, the portio dura of the ſeventh, and the upper cervical nerves, are entangled in a way which will fatigue the diſſector, and may account for every degree of ſympathy of parts. The par vagum, lying behind the internal carotid artery, and as it were, eſcaping from the confuſion of the ninth acceſſory and gloſſo-pharyngeal nerves, deſcends and ſwells out into a kind of ganglion ‡. We now obſerve three branches to be ſent off: The FIRST and SECOND PHARYNGEAL NERVES, which paſs to the conſtrictor pharyngis muſcle, and the INTERNAL LARYNGEAL NERVE.

* Scarpa. † Sabatier.

‡ *Truncus gangliformis* OCTAVI, *tumidulum, corpus olivare* Fallopii; but it is ſuſpected that in this he meant the ganglion of the ſympathetic nerve.

This

This laſt mentioned nerve is even larger than the gloſſo-pharyngeal nerve. It is behind the carotid artery, and paſſes obliquely downward and forward. In its progreſs the principal branch paſſes under the hyo-thyroideus muſcle, and betwixt the os hyoides and the thyroid cartilage; while others, more ſuperficial, paſs down and are connected with the EXTERNAL LARYNGEAL, or PHARYNGO-LAYNGEUS; which is a nerve formed by the ſympathetic and par vagum conjointly. The principal branch of the internal laryngeal nerve, which runs under the hyo-thyroideus, is diſtributed to the ſmall muſcles moving the cartilages. The minute extremities of this nerve paſs alſo to the apex of the epiglottis, and the glandular membrane covering the glottis. We have at the ſame time to remark a very particular communicating nerve betwixt this internal laryngeal nerve, and the recurrent branch of the par vagum. This branch is deſcribed by Galen. The par vagum continues its uninterrupted courſe betwixt the carotid artery and jugular vein, and is involved in the ſame ſheath with theſe veſſels. In this courſe down the neck, it ſometimes ſends back a twig which unites with the ninth pair, and when near the lower part of the neck, it ſends forward twigs to unite with thoſe from the ſympathetic nerve, which paſs down to the great veſſels of the heart, to form the ſuperior cardiac plexus *. On the right ſide, thoſe nerves to the great veſſels are in general given off by the recurrent nerve.

The par vagum now penetrates into the thorax by paſſing before the ſubclavian artery; it then ſplits into two. The main nerve paſſes on by the ſide of the trachea, and behind the root of the lungs; while the branch, on the right ſide, turns round under the ſubclavian artery, on the left, under the arch of the aorta, and aſcends behind the trachea to the larynx.

This aſcending branch of the par vagum is the RECURRENT NERVE. On the right ſide it is ſometimes

* The courſe of theſe nerves to the heart, is beſt treated of with the branches of the ſympathetic nerve.

double.

double. It aſcends behind the carotid artery, and ſometimes is thrown round the root of the thyroid artery. On the left ſide, which, from its turning round the arch of the aorta, is much lower than on the right, it gives off filaments which go to the lower cardiac plexus, after having united with the branches of the ſympathetic. Under the ſubclavian of the right ſide, alſo, there are ſent branches from the recurrent to the cardiac plexus; and on both ſides there paſs branches of communication betwixt the ſympathetic nerve and the recurrent. When the recurrent nerve has turned round the artery, it aſcends in a direction to get behind the trachea, and it lies betwixt the trachea and æſophagus. It here ſends off many branches to the back and membranous part of the trachea which pierce this poſterior part, to ſupply the internal membrane. It gives alſo branches to the æſophagus and thyroid gland. The final diſtribution of this nerve is to the larynx. It pierces betwixt the thyroid and cricoïd cartilages, and ſeparates into many filaments, which terminate in the crico-arytenoideus, lateralis and poſticus, and thyro-arytenoideus, and in the membrane of the larynx. We have already mentioned the branch of communication betwixt the recurrent and internal laryngeal nerves *, and Sabatier deſcribes a branch of the recurrent, which ſometimes aſcends and joins the ſympathetic high in the neck.

Two caſes, mentioned by Galen, of ſcrophulous tumours in the neck opened, where the conſequence was loſs of voice, have tempted many anatomiſts to inſtitute experiments on the recurrent and internal laryngeal nerves †. Notwithſtanding the deep ſituation of thoſe recurrent nerves, Galen ſays, they were cut in theſe caſes, and he believed that the branch of communication betwixt the laryngeal and recurrent reſtored the

* There is a double communication betwixt thoſe nerves; in the firſt place by this more ſuperficial branch, and again by ſeveral internal and more minute branches.

† Martin, in the Edinburgh Eſſays, Profeſſor Sue of Paris, Dr. Highton, in the Memoirs of the Medical Society of London; Cruikſhanks, Profeſſor Scarpa, Arnemann, &c.

voice

voice after ſome time had elápſed. Both the internal laryngeal and recurrent nerves are neceſſary to the formation of the voice. Experiments have been made upon them in dogs, and the reſult is curious; although the leſſer changes of the ſtrength, acuteneſs, and modulation of the voice could not be well obſerved in the lower animals. When the laryngeal nerve is cut, the voice is feeble but acute; when the recurrent nerve is cut, there is a relaxation of thoſe muſcles moving the artenoid cartilages which command the opening of the glottis, and in conſequence the voice is flatter or graver, or more raucous.

The par vagum, after ſending off the recurrent nerve, deſcends by the ſide of the trachea. Before it paſſes behind the veſſels and branch of the trachea going to the lungs, it ſends minute branches which form the ANTERIOR PULMONIC PLEXUS *. This plexus is entangled in the connections of the pericardium, and is diſſected with difficulty. The branches of this plexus throw themſelves round the pulmonic arteries and veins, and follow them into the lungs.

The par vagum, paſſing on behind the root of the lungs, forms the POSTERIOR PULMONIC PLEXUS. From this alſo the nerves proceed in to the lungs, by attaching themſelves to the pulmonic arteries and veins, and broncheal arteries, and the branches of the trachea †.

The

* I do not conceive that this plexus admits of any uſeful diviſion, or requires any diſtinction of name.

† *Nerves of the Lungs.*—Galen, Veſalius, and others, conceived that there were very few nerves ſent to the lungs, and that thoſe which were, went only to the membranes, and not to the ſubſtance of the lungs. They believed alſo that the diſcharge of blood from the lungs and the exiſtence of vomicæ without pain, while there was great pain in peri-pneumony, was a confirmation of this opinion. Fallopius corrected this idea, and ſhewed that the bronchiæ were alſo attended through their courſe with nerves. There often exiſts vomicæ and effuſions of blood in the lungs; and Haller ſays, the lungs can be lanced without the animal feeling pain, but ſtill the bronchiæ are extremely ſenſible.—Water accumulated in the interlobular cellular membrane, or the infarction of blood into it, gives no acute pain, but only a ſenſe of weight and difficulty of breathing. It is an oppreſſion in a great meaſure depending upon the return of the blood

The trunks of the nerve, continuing their courſe upon each ſide of the æſophagus, unite and ſplit into branches, and again unite ſo as to form a netting upon the æſophagus; theſe are the ANTERIOR and POSTERIOR PLEXUS GULÆ, or ÆSOPHAGEAL PLEXUS. The par vagum, thus attached to the æſophagus, pierces the diaphragm with it, the anterior plexus unites again into a conſiderable trunk, is attached to the leſſer arch of the ſtomach. It ſtretches even to the pylorus, and ſends its branches to the upper ſide of the ſtomach and to the leſſer omentum; at the ſame time it unites with the left hepatic plexus, ſome of its branches terminate in the ſolar plexus, which ſurrounds the root of the cæliac artery. The poſterior æſophageal plexus, likewiſe uniting again into a conſiderable cord when it has come into the abdomen, ſends branches to encircle the cardiac orifice of the ſtomach; it branches alſo to the inferior ſide and great arch of the ſtomach; it ſends alſo branches to the ſplenic plexus and ſolar ganglion.

Thus we ſee that the par vagum has a moſt appropriate name, and that it is nearly as extenſive in its connections as the ſympathetic itſelf. It is diſtributed "to the æſophagus, pharynx, and larynx; to the thyroid gland, veſſels of the neck and heart, to the lungs, liver and ſpleen, ſtomach, duodenum, and ſometimes to the diaphragm." The recollection of this diſtribution will explain to us many ſympathies; for example, the hyſterical affection of the throat when the ſtomach is diſtended with flatus; the exciting of vomiting by tickling the throat; the effect which vomiting has in diminiſhing the ſenſe of ſuffocation; that ſtate of the ſtomach

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blood from the lungs, unchanged in conſequence of the compreſſion of the cells.—The ſenſibility of the bronchiæ, and the exiſtence of their nerves, appear in aſthma; and alſo from the pain excited by calculi, and from their irritability excited by recent ulceration, or when vomicæ are diſcharged into them.

The connection betwixt the ſtomach and bronchiæ, through the medium of the par vagum and pulmonic plexus, is evident from thoſe aſthmatic attacks which depend upon foulneſs in the ſtomach.

which

which is found upon diffection to accompany hydrophobia, whether fpontaneous, or from the bite of a dog.

OF THE ACCESSORY NERVE; OR THIRD DIVISION OF THE EIGHTH PAIR OF NERVES.

THE fpinal acceffory nerve of Willis is that which, taking its origins like the cervical nerves from the fpinal marrow, afcends through the fpine and foramen magnum of the occipital bone, and paffes again from the fcull like one of the nerves of the brain. It paffes out with the par vagum, is attached to it in its paffage, but again feparates from it when it has efcaped from the fcull. Under the bafe of the cranium it is attached to the ninth pair alfo. Commonly this attachment is firm; fometimes, it is by a fhort filament. This parafitical nerve then paffes behind the internal jugular vein, and paffes obliquely downward and backward. It then perforates the maftoid mufcle, and paffes in a direction acrofs the neck to the fhoulder. While it pierces, it gives nerves to the maftoid mufcle; and after piercing, it entangles its branches with thofe of the third and fourth cervical nerves. It then paffes under the trapezius mufcle, and is diftributed to it, where it is on the back of the neck and fhoulder. From the diftribution of this nerve, fays a Frenchman, we difcover that the fhrug of the fhoulders is very natural; and " pourquoi les grandes paffions de l'ame nous portent à gefticuler, pour ainfi dire, malgré nous *!"

OF THE NINTH PAIR, LINGUALIS MEDIUS; OR HYPOGLOSSUS.

AFTER paffing out from the fcull by the anterior condyloid foramen, the ninth nerve adheres to the eighth pair, by cellular filaments and the interchange of nerves. It receives alfo branches from the firft cervical nerve, or from the branch of union of the firft and fecond cervical nerves. When diffecting in the neck, we find the

* Sabatier.

ninth

ninth nerve lying by the ſide of the internal jugular vein under the ſtyloid muſcles, and coming out from under the occipital branch of the internal carotid artery.

The nerve here divides, or it may rather be ſaid to give off that branch which is called the DESCENDENS NONI. The continued trunk of the nerve paſſes before the external carotid artery, and forwards under the larger branches of veins in a direction tending towards the os hyoides. Here it turns upwards under the ſtylo-hyoideus and digaſtricus muſcles, and betwixt the ſtylo-gloſſus and hyo-gloſſus. Where the nerve is near the os hyoides, and paſſing under the ſtylo-gloſſus muſcle, it ſends down a twig which paſſes to the fore-part of the throat, and chiefly to the ſterno-hyoideus and thyro-hyoideus.

The continued nerve is diſtributed to the muſcles of the tongue and lower jaw, and glands under the jaw; and it terminates by numerous filaments, which form a net-work amongſt the muſcles of the tongue; to which is united part of that branch of the fifth pair which goes to the tongue *.

The RAMUS DESCENDENS NONI paſſes downward, and obliquely over the trunk of the carotid artery, and under the thyroid vein. In the ſuperficial diſſection of the muſcles of the neck, two ſlender twigs of nerves will be ſeen to come from the ſide of the neck, and croſſing the jugular vein, unite to this deſcending branch. Thoſe twigs come from the ſecond and third cervical nerves †; and a little ganglion or plexus is formed by their union with the deſcendens noni. From this center are ſent out many delicate and ſuperficial nerves to the omo-hyoideus and ſterno-thyroideus muſcles.

Thus we find that the ninth nerve has connections with the eighth pair of nerves, with the ſpinal acceſſory,

* This has been called *plexus cerato-baſib-ſtylo-gloſſus !*

† In ſome inſtances thoſe twigs are found to be derived from the firſt origin of the phrenic nerve.

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the ſympathetic, the cervical, and phrenic nerves. When this nerve is injured, the motion of the tongue is loſt, but the ſenſe of taſte remains unimpaired. On the contrary, when the branch of the fifth nerve going to the tongue is hurt, the ſenſe of taſte is loſt, while the mobility of the tongue remains *. Columbus knew a man who had no ſenſe of taſte, and who ate indifferently every thing preſented to him. When he died, Columbus was curious to know the cauſe of this, and he found that he altogether wanted the guſtatory nerve or lingual branch of the inferior maxillary nerve. Caſes detailed by profeſſor Scarpa ſtill further illuſtrate this fact. A woman, ſubject to epileptic attacks in an early age, was ſeized in her pregnancy with an hemiplegia and loſs of ſpeech. From this attack, by the uſe of medicines, ſhe recovered; but in a future labour the diſeaſe recurred. Now the cure was leſs complete; for, though ſhe regained the uſe of her arms, ſhe never recovered the faculty of ſpeech, or was only capable of articulating with great diſſonance the monoſyllables, affirming or denying. Upon making her exert herſelf to ſpeak, they obſerved no motion in the tongue; and, upon applying the hand under the jaw, they could feel no motion in the muſcles of the tongue; yet ſhe reliſhed her food and drink, and had an acute ſenſe of taſte, and could ſwallow eaſily. He mentions another caſe, where the patient was attacked with a ſenſe of weight at the root of the tongue, a difficulty of ſpeaking, and copious flow of ſaliva. In a ſhort time he intirely loſt the power of articulating, but retained acutely the ſenſe of taſte †.

From the extenſive connection of this nerve, particularly with the eighth and ſympathetic nerves, we ſee why tremors of the tongue and aphonia may be occaſioned by hyſteria, hypochondriaſis, colics, or worms in the inteſtines ‡.

* Soemmerring de Cerebro & Nervis.
† Tabulæ Neurologicæ, Auctore Anton. Scarpa.
‡ J. F. Will. Bachmer Comment. de 9no pare Nervorum.

OF

OF THE CERVICAL NERVES.

FIRST CERVICAL NERVE. TENTH PAIR OF THE SCULL. SUB-OCCIPITAL NERVE. This is the leaſt of all the nerves of the ſpine; it ariſes by two roots from the medulla ſpinalis. Some difference has been obſerved in the manner in which thoſe roots collect their filaments; and only the anterior root or faſciculus is deſcribed by ſome authors. The poſterior faſciculus is indeed the larger, and comes in a direction different from the general direction of the roots of the other cervical nerves. The roots of the ſub-occipital nerve are connected with the ſpinal acceſſory nerve, but ſeldom form a ganglion with it; and frequently they form a union with the poſterior roots of the ſecond cervical nerve. The fibres of the ſub-occipital nerve paſſing tranſverſely and a little obliquely upwards, go out under the vertebral artery, and betwixt it and the firſt vertebra of the neck. The little trunk of the ſub-occipital nerve, thus formed, and having eſcaped from the ſpine, riſes for a little way upwards, ſwells into a kind of ganglion, and then divides into two branches.

The anterior of theſe branches is the ſmaller. It paſſes down upon the inſide of the vertebral artery; its filaments unite with the hypogloſſal nerve, or ninth pair, and with the ſuperior cervical ganglion of the ſympathetic, and with the firſt branch of the ſecond cervical nerve *. The larger and poſterior branch divides into eight twigs, which are chiefly diſtributed to the muſcles moving the head—to the obliquus ſuperior and inferior, the recti poſtici and laterales, complexus, and ſplenius. Some of thoſe muſcular branches unite with that branch of the ſecond cervical nerve which aſcends upon the occiput.

* A very ſmall nerve is deſcribed by ſome authors as paſſing from the anterior diviſion of this nerve, into the canal of the vertebral artery.

SECOND CERVICAL NERVE. This nerve, arifing by a double origin from the fpinal marrow, like the other nerves of the fpine, paffes betwixt the firft and fecond vertebræ. It is larger than the laft; and, after forming a little ganglion by the fide of the tranfverfe procefs of the firft vertebra, divides into two branches.

The SUPERIOR BRANCH fends up a confiderable divifion behind the projection of the tranfverfe procefs of the firft vertebra, to be united to the fub-occipital or firft cervical nerve. Several twigs pafs forward to unite with the fuperior cervical ganglion of the fympathetic nerve, and with fome of the more anterior branches of the third cervical nerve, and with the ninth and fpinal acceffory nerves. Befides thefe intricate connections, irregular branches of this nerve proceed to the fmall mufcles, moving the head and lying on the fore-part of the fpine. The *pofterior* branch of the fecond pair of cervical nerves is chiefly a mufcular nerve. It rifes up by the fide of the complexus, gives branches to that mufcle and to the fplenius, and communicates with the branches of the firft cervical. Its branches are alfo diftributed to the upper part of the trapezius mufcle, from which they extend along the integuments, covering the occiput even to the fummit of the head.

The THIRD CERVICAL NERVE, in the firft place, communicates with the fecond and fourth cervical nerves, with the fympathetic and lingual nerves, and fometimes fends down a twig to unite with the origin of the phrenic nerve from the fourth cervical nerve.

From the anterior divifion of the third cervical nerve, branches pafs to the fplenius and complexus, and trapezius, and upwards to the ear. We may obferve alfo a cutaneous nerve which accompanies the external jugular vein, viz. NERVUS SUPERFICIALIS COLLI; the diftribution of which is chiefly to the angle and margin of the lower jaw, while fome of its branches enter the parotid gland, and unite with the extremities of the portio dura and other facial nerves.

The SMALL POSTERIOR DIVISION of the nerve paffes to

to the complexus, ſpinalis cervicis, and multifidus ſpinæ, while at the ſame time it unites to the branches of the ſecond cervical nerve.

The FOURTH CERVICAL NERVE, coming out from betwixt the third and fourth cervical vertebræ, divides into its anterior and poſterior branches like the other cervical nerves.

The firſt goes to form, with the third and fifth cervical nerves, the PHRENIC NERVE. It ſends alſo a branch to the ſympathetic, to the integuments of the neck and ſhoulder, and to the ſupra and infra ſpinatus muſcles. Theſe are called by Soemmerring SUPERCLAVICULARES ANTERIORES, MEDII, and POSTERIORES.

The great POSTERIOR DIVISION of the fourth cervical nerve, paſſes to the muſcles of the ſpine and ſhoulder, in conjunction with the branches of the third cervical nerve.

FIFTH CERVICAL NERVE.—This nerve comes of courſe from betwixt the fourth and fifth vertebræ, and from betwixt the ſcaleni muſcles. It divides alſo into two branches. The SUPERIOR of theſe paſſes backwards to the muſcles of the back and ſhoulder, and a branch formed by it; and the ſixth paſſes down under the ſcapula and ſerratus major. This ſuperior diviſion of the nerve ſends up alſo two ſmall twigs of communication with the fourth cervical nerve.

The INFERIOR DIVISION of the nerve ſends down upon the ſide of the neck a conſiderable branch to the formation of the phrenic nerve. It communicates with the root of the ſixth nerve, and ſends muſcular branches backward.

The SIXTH CERVICAL NERVE.—The muſcular branches of this nerve are large, and extenſive in their courſe. They paſs into the levator ſcapulæ, extend under the trapezius, and unite with the extreme branches of the ſpinal acceſſory nerve. They are prolonged to the latiſſimus dorſi and ſerratus magnus. Branches alſo extend down behind the clavicle, and under the pectoral muſcle.

 Beſides

Besides these branches, this nerve communicates with the fifth, and gives out an origin to the phrenic nerve; and lastly, uniting to the seventh, it passes into the axillary plexus.

The SEVENTH CERVICAL NERVE.—This nerve goes almost entirely to form the axillary plexus. There is a communicating nerve from the last to this, and from that communicating branch generally there passes off a filament to the phrenic nerve; and from the very root of the nerve there passes off a branch to the lower cervical ganglion of the sympathetic. Irregular twigs also descend from this nerve under the clavicle to the pectoralis minor and major.

The EIGHTH CERVICAL NERVE.—The greater part of this nerve passes to the axillary plexus. It sends small branches to the lower cervical ganglion of the sympathetic, and to the muscles of the breast; which last descend behind the clavicle.

RECAPITULATION OF THE DISTRIBUTION OF THE CERVICAL NERVES.

UPON reviewing the description of these nerves, we find that the general tendency of their branches is backwards over the side of the neck, to the muscles moving the head and shoulders. We find also that they are connected in a very intricate manner with the most important nerves of the cranium. High in the neck and under the jaw, they are connected with the portio dura, with the fifth pair, with the eighth and ninth pairs, and with the sympathetic. Towards the middle of the neck they are still throwing their connecting branches to the descendens noni, and sympathetic, and eighth pair. The lower cervical nerves again are still supporting their connections with the lower ganglion of the sympathetic.

Further, we find the phrenic nerve derived (most frequently) from the third and fourth, and branch of communication betwixt the fourth and fifth. The AXIL-

LARY PLEXUS is formed by the fifth, ſixth, ſeventh, and eighth cervical nerves, and firſt of the back.

OF THE DORSAL NERVES.

THERE are twelve dorſal nerves. Theſe, as we have deſcribed, are formed by two faſciculi of fibres; one from the fore, and the other from the back part of the ſpinal marrow. Theſe filaments run for ſome way ſuperficially in the length of the ſpinal marrow before they pierce the dura mater. They pierce it ſeparately; the poſterior branch firſt forms a ganglion, and then the two faſciculi are united. They are now betwixt the heads of the ribs. We muſt here recollect, that the trunk of the ſympathetic nerve, which paſſes along the cavity of the thorax, runs down behind the pleura, and paſſes before the heads of the ribs through all the length of the back. It receives, as it paſſes, the interſtices of the ſeveral ribs, at each interval, a communicating nerve from the ſpinal marrow; a branch from the intercoſtal or dorſal nerves.

Thoſe communications are ſent in the following manner: the proper dorſal, or intercoſtal nerve ſends its greater branch forwards betwixt the ribs; ſome leſſer branches pierce backwards to the muſcles of the back; oppoſite to this there goes out from each nerve the firſt branch of union with the ſympathetic, and this union forms a firm ganglion. Sometimes there run out in this direction two ſhort branches from the ſpinal nerve, to unite with the ganglion of the ſympathetic; but more commonly there paſſes in a retrograde direction from the intercoſtal nerve, where it is about to take its courſe between the ribs, another branch of communication which joins the ſympathetic. Sometimes the dorſal or intercoſtal nerves ſend off three communicating branches to the ſympathetic.

The intercoſtal nerves paſs on betwixt the ribs, in company with the intercoſtal arteries, and reach even to the ſternum. In this courſe they ſupply the intercoſtal muſcles and triangularis ſterni, while they are at the ſame time ſending out branches, which, piercing the

intercoſtal muſcles and faſcia of the thorax, are diſtributed to the muſcles on the outſide of the cheſt.—Thoſe branches which we mentioned as paſſing betwixt the heads of the ribs, and which are ſent off immediately upon the trunk eſcaping from the vertebral opening, ſupply the multifidus ſpinæ and levatores coſtarum, and other extenſor muſcles of the ſpine. Slips proceeding from the ſecond, third, fourth, and fifth intercoſtal nerves, ſend branches to the pectoral muſcles, the ſerratus anticus, and ſerratus poſticus ſuperior, trapezius, and rhomboides. The ſixth, and all the lower nerves of the back, ſend branches from betwixt the ribs to the latiſſimus dorſi, ſerratus inferior, and abdominal muſcles. The eleventh and twelfth are diſtributed to the diaphragm, quadratus lumborum, pſoas magnus, and iliacus internus.

LUMBAR NERVES.

The lumbar nerves are five in number. The firſt comes out under the firſt lumbar vertebra, and the others in ſucceſſion. Their trunks are covered by the pſoas magnus. They paſs very obliquely downward, and the three loweſt are of remarkable ſize.

In the general diſtribution, we may firſt remark the poſterior branches, which go backwards to the muſcles which ſupport and extend the ſpine. Again, the anterior branches; which give, 1ſt, additional branches to the ſympathetic nerve as it paſſes over the vertebræ of the loins, and by which it is ſupported and reinforced till it terminates in the pelvis; 2dly, they have frequent connection with each other, and with the laſt nerve of the back, and firſt of the ſacrum; 3dly, they ſend out branches, delicate but of great extent, to the muſcles of the loins and back, and to the abdominal muſcles and integuments of the groin and ſcrotum; 4thly, the principal anterior branches of the lumbar nerves paſs down to form (along with the great nerves of the ſacrum) the anterior crural nerve, the obturator, and the great iſchiatic nerve.

SACRAL NERVES.

The nerves which come out from the extremity of the medulla ſpinalis, or cauda equina, through the ſacrum, are in general five in number. Sometimes there is one more or leſs. The firſt diviſion of each ſacral nerve is into thoſe branches which paſs out by the poſterior foramina of the ſacrum, and thoſe which, by the anterior foramina, come into the pelvis. The poſterior branches are very ſmall, and paſs to the muſcles ſupporting the ſpine; while the anterior ones are particularly large, eſpecially the firſt and ſecond, which, with the loweſt of the loins, go to form the largeſt nerve of the body, the iſchiatic nerve.

It is difficult to recollect the diſtribution of the ſeveral branches of the lumbar and ſacral nerves, when taken thus together; but when we deliver the deſcription of the nerves of the thigh and leg, we count them, and hold them in remembrance with comparative eaſe. At preſent we are beſt prepared to follow the ſympathetic nerve in its courſe.

OF THE GREAT SYMPATHETIC NERVE, OR INTERCOSTAL NERVE.

Notwithstanding the idea of this nerve which I have endeavoured to convey, I conceive that we muſt ſtill continue to ſpeak of its origins in the uſual way, for the ſake of ſimplicity and arrangement.

The ſympathetic nerve is in general conſidered as originally derived from the ſixth pair; or, we may ſay, it takes its origin from the ſixth, where it paſſes by the ſide of the carotid artery, and from the vidian branch of the fifth pair. It appears without the ſcull, ſometimes behind and ſometimes before the carotid artery, and ſometimes it is double in its exit from the baſe of the ſcull. Almoſt immediately after it has eſcaped from the ſcull, it forms its firſt ganglion; which is very large and remarkable,

remarkable, and has the name of the SUPERIOR CERVICAL GANGLION of the ſympathetic nerve. It is of a ſoft conſiſtence and reddiſh colour, and it extends from the ſcull to the tranſverſe proceſs of the third vertebra. It gradually tapers downwards until it becomes a very ſlender nerve. This ganglion has much variety of ſhape in different ſubjects, and may be ſaid in general to receive twigs of nerves upon the back part; whilſt it gives them out upon the fore part.

The ſuperior cervicle ganglion of the ſympathetic nerve receives nerves from the ſecond, third, and fourth cervical nerves, and even ſometimes from the root of the phrenic nerve. It has alſo connections with the hypo-gloſſal, par vagum, and gloſſo-pharyngeal nerves. It ſends out branches to unite with the gloſſo-pharyngeal, and which follow that nerve in its diſtribution to the tongue and pharynx. Many of its branches ſurrounding the carotid artery form connections with the internal and external laryngeal nerves, and proceed in meſhes, or form plexus along with the branches of the artery. Theſe may be followed to great minuteneſs.

To be more particular in the deſcription of theſe anterior branches of the ſympathetic nerve, they are called the NERVI MOLLES, or NERVI VASORUM. They are nerves peculiarly ſoft, with a greater proportion of cellular membrane; they ſpread in net-works along the arteries, and form frequent connections by little knots like ſmall ganglions. Claſſed with theſe nervi vaſorum, are branches which paſs forward from the upper ganglion of the ſympathetic, to unite with filaments from the internal laryngeal nerve of the par vagum, and which form the external laryngeal nerve. It is remarked, that none of theſe branches of the ſympathetic nerve are diſtributed to the larynx and pharynx without being mingled and aſſociated with the gloſſo-pharyngeal nerve, or with the pharyngeal branch of the par vagum *. Of the nervi molles, ſome form a plexus upon the internal

* Scarpa

carotid

carotid artery. Theſe are extremely ſoft and pulpy, and are united with branches which deſcend from the gloſſo-pharyngeal nerve. A net-work is alſo formed, which covers the beginning of the external carotid artery. From this, as from a center, branches are ſent out with the arteries to the neck, and face, and glands under the jaw; and theſe laſt, with a meſh which paſſes up upon the temporal artery, unite with the portio dura of the ſeventh pair.

It has been often obſerved, that the branches of the carotid artery have a peculiar proviſion of nerves, and that theſe nerves are more numerous and minutely diſtributed than in any other part of the body. There are indeed no nerves in any part of the body which have ſo extenſive and intricate connections with important nerves as the cutaneous nerves of the face and neck.

This diſtribution of the nerves is, I conceive, a proviſion for that power poſſeſſed by the imagination, or rather that uncontrolable connection which exiſts betwixt the feelings and the action of the veſſels in bluſhing.

The loweſt of the nervi vaſorum or molles, ſent off from the ſuperior ganglion of the ſympathetic nerve, deſcends in the courſe of the trunk of the nerve, and forms, with other branches, the ſuperior cardiac nerve.

This nerve, generally called NERVUS CORDIS SUPERFICIALIS, paſſing down in the direction of the trunk of the ſympathetic nerve, and near the longus colli muſcle, is for ſome length a very ſlender branch; but in its courſe it receives two, three, or four additional twigs from the ſympathetic, and branches which come under the carotid artery from the pharyngeal nerves, or nervi molles. When this ſuperior cardiac nerve is within an inch or two of the ſubclavian artery, branches of union paſs betwixt it and the recurrent nerve of the par vagum; and branches of the nerves paſſing to the heart from the lower cervical ganglion, alſo join it. It then, attaching itſelf to the inveſting membranes and ſheaths of the carotid and ſubclavian arteries, forms with others a plexus of nerves, which run along the great veſſels to the heart.

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The continued trunk of the ſympathetic, where it emerges from the ſuperior cervical ganglion, is extremely ſmall. It deſcends behind the carotid artery, and lies near to the ſpine. When oppoſite to the fifth and ſixth cervical vertebræ, the inferior cervical ganglion of the ſympathetic is formed. In this courſe, twigs of communication paſs betwixt it and the cervical nerves, or join it with the beginning of the phrenic nerve.

But not unfrequently there are three cervical ganglions formed by the ſympathetic nerve; the ſuperior, middle, and inferior ganglions: or it happens that we find the ſympathetic nerve ſplit into two branches in the neck; one of which forms the middle, and the other the lower ganglion.

There are received by the MIDDLE CERVICAL GANGLION, or, THYROID GANGLION, branches of nerves from the third, fourth, fifth, and ſixth cervical nerves, and alſo ſometimes from the phrenic nerve. The ganglion is by no means conſtantly found, and it is irregular in its ſize and ſhape. When large, and in what may be conſidered as its more perfect ſtate, it gives off ſome conſiderable branches. Of theſe, part unite with the ſuperior cardiac nerve already mentioned; others from the great or deep cardiac nerve, while leſſer ones play round the ſubclavian artery, and unite with the lower cervical ganglion, or the upper thoracic ganglion.

The deeper cardiac branch of the ſympathetic, ſplitting and again uniting ſo as to form rings, runs outwards, attached to the arteria innominata and arch of the aorta, to the heart. In this courſe, while it paſſes before the trachea, it forms connections with the recurrent branch and trunk of the par vagum. Under the arch of the aorta, we find this branch concentrated to form the GANGLION CARDIACUM of Wriſberg, or GANGLION MOLLE et PELLUCIDUM of Scarpa. This ganglion is like a mere enlargement or ſwelling of the nerve. From this, four or five branches may be enumerated; 1ſt, A branch paſſing behind the pulmonary artery to the back of the heart, and following the left coronary artery; 2dly, A ſmall diviſion to the anterior pulmonary

pulmonary plexus of the par vagum; 3dly, A pretty confiderable branch which, paffing behind the aorta, and betwixt it and the pulmonary artery, is diftributed with the right coronary artery to the anterior part of the heart. On the left fide of the neck, the fympathetic, receiving on the one fide branches from the cervical nerves, and on the other giving off branches, which defcend behind the carotid artery to the heart, (viz. the fuperior cardiac,) often fplits before it forms the middle or thyroid ganglion, and fometimes throws its branches over the thyroid artery, and the ganglion lies upon that artery. Again, from the ganglion there defcend two feries of numerous leffer filaments, which form mefhes upon the thyroid and fubclavian arteries to the heart. Others proceed downward behind the arteries to the lower cervical ganglion. Thofe branches which defcend upon the arteries, intangle the roots of the thyroid, tranfverfalis cervicis, and internal mammary arteries, in their plexus; thefe uniting, follow the fubclavian artery, and form again a plexus upon the arch of the aorta. This is joined by branches from the par vagum and recurrent. The principal branches of this plexus terminate in the cardiac ganglion under the arch of the aorta *.

The LOWER CERVICAL GANGLION of the fympathetic nerve is placed upon the limits betwixt the neck and thorax upon the head of the firft rib, and by the fide of the mufculus longus colli; and it is in part covered by the root of the vertebral artery. The ganglion is of an irregular cufhion-like fhape. It lies clofe to the cervical nerves which go to the brachial plexus, and it receives branches from them †. Branches alfo pafs from this ganglion to the par vagum and recurrent, and alfo pafs

* This defcription of the fympathetic nerve on the left fide follows the more ufual diftribution, but is not peculiar to the left fide.

† And even it receives fometimes from the fifth and fixth, more rarely the feventh and eighth, from the firft and fecond of the back; and laftly, from the phrenic nerve.—Sometimes thefe connections are wanting.

on

on to the cardiac and pulmonic plexus. That nerve, which muſt be conſidered as the continued ſympathetic, throws a ring round the root of the vertebral artery, and ſending out branches upon the ſubclavian, terminates in the firſt dorſal or thoracic ganglion.

THE SUPERIOR THORACIC GANGLION.

THIS ganglion ſurpaſſes the other thoracic ganglions in ſize. It is, indeed, frequently compoſed of many branches of the nerve in the neck, coming both before and behind the ſubclavian artery. It receives alſo nerves from the three or four loweſt cervical nerves, and firſt dorſal nerve. It is of a very irregular figure, or rather it varies exceedingly in its ſhape; ſo that by various anatomiſts it is deſcribed as round, oval, triangular, quadrangular, cylindrical!—Filaments proceed from this ganglion into the canal of the vertebral artery, and to the cellular coat of the ſubclavian artery, and to the cardiac plexus, and alſo to the pulmonic plexus; or to ſupply the poſterior ſurface of the lungs.

SYMPATHETIC NERVE IN THE THORAX.

THE ſympathetic nerve (as we have explained in deſcribing the dorſal nerves) through all its courſe in the thorax, has additional branches from the dorſal or intercoſtal nerves. It forms alſo, while it is lying on the ſide of the vertebræ, a diviſion in the thorax, which it will be important to recollect. This nerve is ſent more forwards upon the body of the vertebræ, and paſſes into the abdomen betwixt the crura of the diaphragm; while the trunk of the ſympathetic continues its courſe by the heads of the ribs, paſſes under the ligamentum arcuatum, and downwards upon the lumbar vertebræ.

The SPLANCHNIC NERVE, then, is this anterior branch of the ſympathetic in the thorax. It is the great nerve of the viſcera of the abdomen. It generally has two or four roots from the trunk of the ſympathetic nerve, where it is oppoſite to the ſixth, ſeventh, and eighth

eighth interçoſtal nerves. It is ſeen lying under the pleura, and paſſing obliquely over the bodies of the lumbar vertebræ, from the ſeventh to the tenth. It then paſſes betwixt the crura of the diaphragm, enters the abdomen, and forms the great ſemi-lunar ganglion.

One or more branches are ſent forward from the ſympathetic, commonly from the ganglions, oppoſite to the interſtice betwixt the ninth and tenth, or tenth and eleventh ribs. Theſe alſo paſs the diaphragm, and unite with the ſemi-lunar ganglion. There is, however, a conſiderable variety to be obſerved both in the origins of the ſplanchnic nerve, and in the number of theſe ſubſidiary branches. A larger branch, going off betwixt the tenth and eleventh ribs, is ſo common, that it has the name of SPLANCHNICUS MINOR, or ACCESSORIUS. This nerve as frequently terminates in the renal plexus, as in the ſemi-lunar ganglion; or ſometimes it ſends branches to both.

CÆLIAC GANGLION AND PLEXUS.

THE ganglion which is called the ſemilunar ganglion, has no regular ſhape—and leaſt of all when it is fully diſſected. It is formed by the ſplanchnic nerve, and by branches which come from the lumbar nerves. It lies by the ſide of the cæliac artery, and conſiſts of many leſſer ganglions, (ſometimes to the number of eleven or twelve,) matted together into a glandular-like ſhape.

The ſemilunar ganglions of the ſplanchnic nerves lye on each ſide of the root of the cæliac artery; their connection with each other is frequent and intricate; ſo that they throw a meſh of nerves round the root and branches of this artery, which is the great ſource of veſſels to the ſtomach, liver, and ſpleen.—This plexus, formed by the ſemilunar ganglions round the cæliac artery, is the ſolar or cæliac plexus.

CÆLIAC PLEXUS.

THE cæliac plexus is the great ſource of nerves to the higher viſcera of the abdomen. The ſplanchnic nerves are the great, but not the only nerves which form this plexus. The par vagum ſends branches down from the ſtomach which join it; and even the phrenic nerve, which is the nerve of the diaphragm, ſends down twigs to unite to the branches of the ſplanchnic and par vagum. We ſhall find alſo ſmall nerves which come from the ſeat of the kidney, and which are derived from the ſuperior lumbar nerves.—Theſe paſs acroſs the crura of the diaphragm, and enter into the cæliac plexus. —In purſuing the nerves of the viſcera further, we have it no longer in our power to follow individual branches, but have rather to mark the courſe, and enumerate the various ſources of the plexus, and net-work of nerves which follow the great veſſels.

From the cæliac plexus, there paſs out from others, 1. Nerves which accompany the phrenic arteries upon the lower ſurface of the diaphragm. 2. Nerves to the liver:—and of theſe there are two plexus, the right and left hepatic plexus; one paſſes along the vena portæ, biliary ducts, and right hepatic artery, to the right ſide of the liver, the gall bladder and ducts; this of courſe is the RIGHT HEPATIC PLEXUS: the LEFT HEPATIC PLEXUS paſſes along the left hepatic artery; and this has connection with the cardiac nerves, branches of the par vagum. 3. That plexus, which runs upon the leſſer curve of the ſtomach, while it is formed in a great meaſure by the par vagum, has alſo connection with the ſolar or cæliac plexus. 4. The plexus of nerves which paſs to the lower orifice of the ſtomach and duodenum is chiefly a diviſion of the right hepatic plexus. Theſe nerves, to the liver, ſtomach, and duodenum, are attached to the branches of the cæliac artery. Along the great ſplenic artery, which is alſo derived from the cæliac artery, there paſſes out a plexus of nerves to the ſpleen. From this ſplenic plexus there paſs nerves to the great omentum;

and

and they even unite with thoſe paſſing out upon the duodenum, and which attach themſelves to the right epiploic artery, and take a courſe upon the great curvature of the ſtomach.

Thus the ſolar or cæliac plexus is a great central net-work of nerves, which paſs out in diviſions to the liver, ſpleen, pancreas, ſtomach, duodenum, and omentum.

SUPERIOR MESENTERIC PLEXUS.

THE place and connections of the ſuperior meſenteric plexus is at once known, when it is conſidered that it is formed upon the root of the ſuperior meſenteric artery.—It is formed by the cæliac plexus being continued down upon the aorta ſo as to involve the root of the meſenteric artery, and by nerves coming over the ſide of the vertebræ of the loins from the lumbar nerves. This plexus ſpreads betwixt the membranes of the meſentery, and extends upon the branches of the artery, and of courſe is diſtributed to the ſmall inteſtines and part of the colon. It conſequently ſupplies the meſenteric glands, and ſends nerves alſo to the pancreas, that join thoſe which it receives from the ſplenic plexus.

INFERIOR MESENTERIC PLEXUS.

THE ſame meſh of nerves, being continued down upon the face of the aorta, ſurround the lower meſenteric artery, and follow its branches. This is the lower meſenteric plexus, or meſocolic plexus; and it is formed in a great meaſure from the branches of the continued trunk of the ſympathetic nerve.—As this plexus ſpreads upon the branches of the lower meſenteric artery, it paſſes to the left ſide of the inteſtinum, colon and rectum—while the lower meſenteric plexus is continued from the upper one. On the ſide of the lumbar vertebræ it is continuous with the renal and ſpermatic plexus; and towards the pelvis, with the hypogaſtric plexus.

Before

Before confidering the other leffer plexus of nerves in the abdomen, it is neceffary to follow the continued trunk of the fympathetic nerve which we had defcribed as following clofely the lateral part of the dorfal and lumbar vertebræ, whilft the fplanchnic nerves pafs obliquely over them to the vifcera of the upper part of the belly.

The CONTINUED TRUNK of the SYMPATHETIC NERVE, after it has given off the fplanchnic nerve in the thorax, fends feveral fmall nerves forward over the vertebræ to the mediaftinum and fheath of the aorta. It then paffes the diaphragm, keeping clofe to the tranfverfe procefs of the vertebræ. When, however, it comes lower upon the lumbar vertebræ, it lies more upon the fide of their bodies, and the connections with the lumbar nerves are by fmall and numerous twigs which ftretch over the fide of the vertebræ. In this courfe, it is giving off upon the fore part numerous irregular twigs to the feveral plexus which have been defcribed. Where it lies under the veffels which pafs to the kidney, it fends up fome branches to the renal plexus.

The renal plexus, however, is not entirely formed of thefe branches of the continued fympathetic, but is rather a continuation from the cæliac and fuperior mefenteric plexus; while the leffer fplanchnic nerve, which was fent off in the thorax, alfo terminates in it. This plexus is thrown over the veffels of the kidney, and forms feveral little ganglions.

From the renal plexus defcends the SPERMATIC PLEXUS with the veffels to the tefticle. This plexus of nerves in woman follows the fpermatic artery in its diftribution to the ovaria and uterus.

In paffing down upon the loins, the fympathetic nerve forms five or fix ganglions with the branches from the lumbar nerves. Thefe are oblong, angular, ftellated—irregular in their form, as in their number, fituation, and fize, as the twigs which, by their union with the fympathetic, form them. Betwixt thefe ganglions or connections with the lumbar nerves, the fympathetic is not always one nerve, but is fometimes fplit into feveral

fmaller

ſmaller nerves, which unite again. From the ſympathetic nerves of either ſide we have to obſerve frequent interchange of branches, which ſometimes attach themſelves to the lumbar nerves, ſometimes creep under the aorta, or unite to the plexus covering the face of the aorta.—There are ſeveral little ganglions formed by theſe nerves upon the face of the lumbar vertebræ: they have the name of ganglia acceſſoria.

Before the ſympathetic nerve deſcends into the pelvis, it has become extremely delicate. In many ſubjects it ſeems to terminate in the laſt lumbar, or firſt ſacral nerve; but, upon more minute diſſection, leſſer branches will be found to deſcend amongſt the looſe cellular ſubſtance of the pelvis.—When regular, or perhaps we may ſay with truth when regularly and fully diſſected, the ſympathetic nerves of each ſide are ſeen to deſcend upon the fore-part of the ſacrum, and form connections with the ſacral nerves ſimilar to thoſe with the dorſal nerves.—As they deſcend, they of courſe approach, and finally unite in an acute point on the os coccigis. At the points of union of theſe extreme branches of the ſympathetic nerves with the branches of the ſacral nerves, ſmall ganglions are formed; and there paſs out branches from them, which cover the intermediate ſurface of the ſacrum with an extenſive plexus. The ultimate ganglion, formed by the union of the two ſympathetic nerves, is the *coccygeal ganglion*, and from it there paſs three or four nerves to the extremity of the rectum.

HYPOGASTRIC PLEXUS.

This is a plexus which lies on the ſide of the pelvis, and involves the hypogaſtric artery. It conſiſts of the nerves paſſing to the parts contained in the pelvis: which do not, however, paſs in diſtinct branches, but like thoſe of the abdomen, are formed into minute interwoven net-work. The hypogaſtric plexus takes no determinate origin, but is continuous with, or formed by, the extreme branches of the ſympathetic nerves, the ex-

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tremity of the ſpermatic plexus, the ſacral nerves, (and particularly the third ſacral nerve,) and by the branches of the acceſſory ganglions on the ſacrum.

OF THE PHRENIC NERVE *.

THE phrenic or diaphragmatic nerve ariſes from the cervical nerves, paſſes obliquely down the neck, enters the thorax, and is diſtributed to the diaphragm.—This nerve has much variety in its derivation. It comes chiefly from the third cervical nerve, deriving alſo ſome twigs from the fourth and ſecond. But ſometimes it takes an origin very high in the neck, from the par vagum or ninth nerve; and even the ſuperior cervical ganglion of the ſympathetic is deſcribed by ſome as furniſhing a root.—Lower in the neck it will be found in ſome ſubjects to derive very ſmall additional twigs from the fifth or ſixth cervical nerves, or lower ganglion of the ſympathetic.

The phrenic nerve, thus formed, deſcends into the thorax betwixt the ſubclavian artery and vein. In the cheſt it proceeds downward and forward, attached to the mediaſtinum, and before the root of the lungs †. It takes its courſe upon the outſide of the pericardium, and from the pericardium ſlips off to the ſurface of the diaphragm. From the poſition of the heart, the left phrenic

* E. Kruger de Nervo Phrenico. Sandefort Theſaur. Vol. III.

† Ludwig. Martin, in the Edinburgh Eſſays, and others, explain the action of the diaphragm upon the ſuppoſition of the mechanical preſſure of the lungs upon the phrenic nerve. It is a piece of doctrine inconſiſtent with knowledge of the general laws of the œconomy. It is repugnant to comparative anatomy, and it is evident that the ſoft and elaſtic diſtention of the lungs could not compreſs the firm nerve. Moreover, the lungs, when diſtended, do not preſs upon the mediaſtinum, for it is the dilation of the thorax which cauſes the lungs to inhale the atmoſpheric air. See *Wriſberg de Nervo Phrenico.* Sander. Theſ. vol. ii. p. 263. It is betwixt the heart and muſcles of reſpiration that the ſtrict relation and ſympathy exiſts. When in turning the child in utero, and when the cord has been preſſed, I have felt the ſtrong convulſive *fetches* of the muſcles of reſpiration endeavouring, by the play of the lungs, to compenſate for the loſs of the placenta.

nerve

nerve differs a little in its courſe from the right; and it paſſes over the pericardium, covering the apex of the heart. The phrenic nerve of the right ſide, beſides ſupplying the diaphragm, ſends down through the diaphragm (to the right ſide of the vena cava) the ramus anaſtamoticus. This communicates with the ſemilunar ganglion of the ſympathetic, or with the diviſion of the ſolar or cæliac plexus which paſſes along the phrenic arteries. From the phrenic artery of the left ſide, there paſs down with the œſophagus ſmall nerves which appearing in the abdomen, unite with the cæliac ganglion, or ſome of its diviſions; and both phrenic nerves will be found by ſome minute branches to unite to the par vagum.

Theſe, however, are but minute branches. The great deſtination of the phrenic nerve is to the diaphragm. The branches ſtrike out from the diaphragm like roots from a centre; they paſs ſome way only covered by the pleura, and then pierce into the ſubſtance of the muſcle. There are innumerable experiments upon living animals, which ſhew the connection of this nerve with the action of the diaphragm. When the nerve is ſtimulated, the diaphragm is excited to contraction; when cut, preſſed, or tied, it becomes relaxed and inactive, and there is difficulty of reſpiration; when the ſpinal marrow is injured low in the vertebræ of the neck, or in the vertebræ of the back the external muſcles of reſpiration ceaſe to act, but the diaphragm ſtill continues its function; and in this caſe, as obſerved by Mr. Hunter, the patient lives for ſome days, breathing by the diaphragm. If the phrenic nerves be divided in a living animal, the diaphragm ceaſes to act, and the abdominal muſcles loſe their opponent muſcles, and remain as in expiration; but ſtill the reſpiration is continued by the motion of the ribs. If after this the ſpine be divided, the motion of the lungs ceaſes entirely, and the animal dies ſuddenly.—The injury of the ſpinal marrow above the origin of the phrenic nerves, is of courſe ſuddenly fatal, becauſe it deſtroys at once the function of the diaphragm, and muſcles moving the cheſt. From the connection of the phrenic nerve with

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the par vagum, we may explain the ſympathy betwixt the trachea and the diaphragm, how the irritation of the trachea occaſions coughing and the convulſive action of the diaphragm; in the ſame manner in the affection of the ſtomach, ſingultus, from the ſudden action of the diaphragm and abdominal muſcles, (which uſually alternate in their action,) may be explained. Again, a connection of nerves might be followed from the origins of the phrenic to the ſympathetic nerve, and branches of the fifth pair to the noſe: which accounts for that ſympathy of action which occaſions ſneezing from irritation of the membrane of the noſe.

NEVES OF THE ARM; AXILLARY, OR BRACHIAL PLEXUS.

THE nerves which proceed from the ſpine, and go to ſu pply the arm, are formed into an intricate plexus before they divide into the ſeveral nerves of the arm.

This brachial, or axillary plexus, is formed of five of the ſpi nal nerves; viz. the fifth, ſixth, ſeventh, and eighth cerv ical nerves *, and the firſt dorſal nerve. The higheſt of th eſe nerves proceed from betwixt the fourth and fifth cervi cal vertebræ; the laſt from betwixt the firſt and ſecond dorſal vertebræ. They paſs out betwixt the middle and a nterior diviſion of the ſcaleni; and even while covere d by theſe muſcles, and before they have proceeded far f rom their foramina, the laſt nerve of the neck and firſt of the back unite †.—The plexus extends from above th e clavicle to the edge of the tendon of the latiſſimus do rſi. It allows of no natural diviſion ‡. The axillary ne rve paſſes for ſome way cloſe under

* This is of courſe counting the ſub-occipital as the firſt cervical nerve.

† Before the nerves which form the plexus intermix their filaments, or are connected together, they ſen d off ſmall branches to the ſcaleni muſcles, to the muſcles of the ſpine, and to the levator ſcapulæ.—The branches which they give to the ſympathetic nerve, we have already noticed.

‡ I mean that it admits of no diviſion uſeful in the arrangement of the

under it, and then perforates betwixt the divifions which form the radial nerve.

From the axillary plexus proceed thefe nerves:

1. The thoracic nerves.
2. The fupra and infra fcapular nerves.
3. The circumflex, or articular nerve.
4. The perforans Cafferii, or external cutaneous nerve.
5. The radial nerve.
6. The ulnar nerve.
7. The mufcular fpiral nerve.
8. The internal cutaneous nerves.

1. The THORACIC NERVES. Although the nerves which fupply the mufcles of the cheft are derived from the intercoftal nerves, as we have feen, yet there alfo pafs off branches from the axillary plexus to the great and little pectoral mufcles, to the latiffimus dorfi, to the fkin and mammæ. Thefe thoracic branches proceed from the upper divifion of the plexus, or that which gives out the external cutaneous, and one of the roots of the radial nerve.

2. The SUPRA-SCAPULAR NERVE comes off from the upper edge of the plexus, and is the higheft of the branches. It runs towards the root of the coracoid procefs, it paffes through the notch of the fcapula, and goes to fupply the fupra and infra fpinatus mufcles, the teres minor, and the fub-fcapularis.

The SUB-SCAPULAR NERVES come out from the pofterior part of the plexus along with the articular nerve. They are attached to the fub-fcapular mufcle, they turn round the flefhy edge of the mufcle, and infinuate their branches betwixt the tendon of the latiffimus dorfi and the teres major.

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the demonftration. See Monro's Nervous Syftem, and the Latin work of Anton. Scarpa. Scarpa defcribes the connection of filaments betwixt the ulnar and radial nerve at their feparation from the great plexus, *Plexus brachialis minor*. Vide tab. ii. fig. ii. h.

3. The CIRCUMFLEX, or ARTICULAR NERVE, or AXILLARIS, lies very deep. It comes from the back part of the plexus, paſſes behind the neck of the humerus, and above the tendon of the latiſſimus dorſi, and teres major. One of its branches we trace into the teres major, while another paſſes round the bone, and is diſtributed to the under ſurface of the deltoid muſcle, the joint, and the cellular membrane.

4. PERFORANS CASSERII, or the EXTERNAL CUTANEOUS NERVE. This nerve paſſes through the coraco-brachialis muſcle before the os humeri, to gain the outſide of the arm. From its perforating this muſcle, and being deſcribed by Caſſerius, it is called the nervus perforans Caſſerii. Before paſſing through the coraco-brachialis muſcle, it ſends down a branch of communication with the radial nerve; and in many ſubjects it will be found to be like a branch from one of the origins of the radial nerve. Where the nervus perforans lies betwixt the brachialis internus muſcle and biceps, (and, of courſe, after it has perforated the coraco-brachialis muſcle), a branch or two are ſent up to the heads of the biceps muſcle; another branch turns inward to the belly of that muſcle; and, finally, twigs paſs inward to the cellular membrane, which involves the brachial artery.

The continued nerve paſſes obliquely acroſs the arm, and under the biceps. When approaching the outſide of the arm, it divides into three ſmall branches; one to the integuments which are upon the ſupinator longus, another to the integuments on the inſide of the fore-arm, and a third, which continues its courſe along the edge of the ſupinator longus to the wriſt. Of this prolonged branch of the perforans Caſſerii, a minute twig is loſt on the ligament of the wriſt, another paſſes to the ball of the thumb, and a third goes round to the integuments of the back of the thumb.

5. The RADIAL NERVE. This nerve is formed by thoſe diviſions of the plexus which ſurround the brachial artery, and ſometimes by a diviſion of the perforans Caſſerii. It takes its courſe by the ſide of the brachial

brachial artery, and gives off no branches until it has ſunk under the aponeurotic expanſion of the biceps muſcle.

When the radial nerve has come to the bend of the arm, it gives off three branches. The firſt belongs to the pronator teres, flexor radialis, palmaris longus, and flexor digitorum; a ſecond paſſes to the pronator teres; a third to the deep muſcles of the fore-arm, to the flexors of the thumb particularly, and alſo to the pronator quadratus muſcle. The radial nerve, continuing its courſe down the fore-arm betwixt the flexor ſublimis and profundus digitorum, ſends off other branches to thoſe muſcles. Before paſſing under the ligament of the wriſt, it gives out a branch which emerges from the tendons, and paſſes to the integuments, ſhort flexor, and abductor muſcles of the thumb.

The trunk of the radial nerve paſſes with the tendons of the flexor muſcles of the fingers under the ligament of the wriſt. In the palm of the hand it divides into five branches;—the firſt paſſes to the abductor and flexor pollicis brevis; a ſecond goes to the adductor pollicis, and ſide of the thumb next the fore-finger; the third paſſes to the fore-finger, and to the lumbricalis muſcle; the fourth to the ſide of the fore and middle fingers; and the fifth to the ſides of the middle and little finger. All theſe nerves, while in the palm of the hand, ſend off branches to the lumbricales muſcles.

6. The ULNAR NERVE comes off from the lower part of the plexus in union with the internal cutaneous nerve. It deſcends upon the inſide of the arm, and is tied down by the faſcia, and then paſſes behind the internal condyle of the humerus. While above the bend of the arm, it gives off a ſuperficial branch to the integuments on the inſide of the arm, and the ulnar ſide of the fore-arm; at the ſame time it ſends a muſcular branch through the triceps muſcle, along with the arteria profunda inferior. Immediately above the elbow joint, twigs are ſent off, ſome of which accompany the

ramus anaſtamoticus major of the brachial artery. After paſſing the condyle of the humerus, it ſends a branch to the flexor carpi ulnaris, and to the head of the flexor digitorum profundus. It then ſinks deeper betwixt the flexor ulnaris and flexor digitorum ſublimis; it is here connected with the ulnar artery, and deſcends along with it to the wriſt. In this courſe, along the fore-arm, the ulnar nerve gives branches to the flexor digitorum ſublimus. Often it ſends a branch of communication to the radial nerve, while ſome few leſſer muſcular nerves are ſent off, and accompany the branches of the ulnar artery.

When arrived near the wriſt, the ulnar nerve divides into two branches. The continued trunk paſſes on under the protection of the tendon of the flexor ulnaris, and then under the annular ligament into the palm of the hand; while the branch takes a turn under the flexor ulnaris, and over the edge of the flexor digitorum profundus. It paſſes then over the lower end of the ulna to the back of the hand. On the back of the hand it is found branching over the expanded tendons and under the veins, and is finally diſtributed to the back of the little and ring fingers. This is the *ramus poſticus*.

The continued ulnar nerve paſſes under the palmaris brevis muſcle and palmar apponeuroſis, and above the flexor brevis and adductor minimi digiti. Here it divides into two, (the ſublimis and profundus of Camper,) and theſe again into four principal branches—to the integuments on the ulnar edge of the hand, and adductor minimi digiti—to the outer edge of the little finger,—to the ſide of the little and ring fingers, and a branch which communicates with the radial nerve.

Albinus, Monro and Camper differ in regard to the diſtribution of nerves to the lumbricales muſcles, which only proves that the twigs paſſing to thoſe little muſcles are irregular. They come chiefly from the deep branch of the ulnar nerve, whilſt others are from the radial nerve.

7. The MUSCULAR SPIRAL NERVE. We find the external cutaneous nerve, or perforans Caſſerii, paſſing before

before the arm-bone. The mufcular fpiral nerve paffes behind the bone, and takes a fpiral turn under it to get to the outfide of the arm. It perforates the flefh of the arm betwixt the middle and the fhort head of the triceps mufcle. Before it perforates the triceps mufcle, the mufcular fpiral fends off branches which pafs over the tendon of the latiffimus dorfi; and before it enters the triceps mufcle, it may be obferved to divide into feveral branches. Three of thefe may be mentioned: a branch to the middle head, and one to the fhort head of the triceps mufcle, and a third and larger nerve which pierces betwixt the mufcles, along with the trunk of the nerve.

This laft nerve does not follow the trunk of the nerve in its courfe, but perforating the triceps more directly acrofs, it comes out behind the fupinator longus, where it takes its origin from the os humeri. This is a cutaneous branch, and might be confidered as the external cutaneous nerve with as much propriety as the perforans Cafferii. Often we fhall find fome leffer branches of the mufcular fpiral nerve piercing the fibres of the triceps mufcle, and terminating in the fkin.

The great cutaneous divifion of the nerve, after piercing the triceps mufcle, takes its courfe along the integuments covering the fupinator longus mufcle; and here it fends a branch in upon the bend of the arm, and on the edge of the triceps mufcle. It then defcends upon the outfide of the fore-arm, and divides into three principal branches, and then again into innumerable cutaneous twigs, and is continued down over the back of the thumb and hand.

But the great divifion of the mufcular-fpiral nerve comes out betwixt the head of the fupinator longus mufcle and the bone, and is deep feated. This branch then lies betwixt the fupinator longus, and brachialis internus; and here it gives off feveral fmall twigs to the mufcles. Continuing its courfe by the fide of the fupinator longus and flexor radialis, it divides into a deep and fuperficial branch. The fuperficial branch paffes

down on the ſide of the tendon of the ſupinator longus, and near the wriſt it becomes quite ſuperficial, and is diſtributed to the integuments of the back of the hand.

8. The INTERNAL CUTANEOUS NERVES. Of thoſe we may deſcribe three:—

1. The *great internal cutaneous nerve.* This nerve is derived from the ulnaris at its root, or comes off from the plexus along with it, paſſes down the arm, giving off no conſiderable branches, accompanies the baſilic vein and twiſts its branches over it, divides into four branches upon the faſcia of the fore-arm, and running betwixt the faſcia and veins of the fore-arm, it is finally diſtributed to the cellular membrane and integuments, while one of its branches reaches to the ligaments of the wriſt.

2. The *cutaneous nerve of Wriſberg* comes ſometimes from the axillary plexus, as a diſtinct nerve; ſometimes it is a branch of the great internal cutaneous nerve; ſometimes it is derived, or a nerve which takes its place is derived from the intercoſtal nerves. This nerve of Wriſberg is diſtributed to the integuments of the arm, and terminates near the internal condyle.

3. The *upper and internal cutaneous nerve* comes from the firſt intercoſtal nerve, or from the ſecond, and paſſes out betwixt the firſt and ſecond ribs. It ſupplies the integuments of the arm, and the glands and fat of the axilla *.

There are beſides ſeveral nerves derived from the intercoſtal nerves, which croſs the axilla, and ſupply the arm-pit and ſide.

NERVES OF THE THIGH, LEG, AND FOOT.

IN tracing the nerves of the lower extremity, we find no difficulty in the arrangement at leaſt, for they fall into a very ſimple and natural order. They are

* See Syſtem of Diſſections, vol. ii. plate 1. g.

all

all derived from the lumbar and ſacral nerves. The great nerves are three in number. One paſſes out under Poupart's ligament to the extenſor muſcles of the leg, *viz.* thoſe which lie on the fore-part of the thigh. This of courſe is called the anterior crural nerve. The ſecond nerve is the obturator nerve, ſo called becauſe it paſſes out from the pelvis by the thyroid hole. This nerve lies amongſt the deep muſcles of the thigh, and diſtributes its branches chiefly to the adductor muſcles. The third nerve is the greateſt nerve of the body, *viz.* the iſchiatic nerve. It paſſes out from the back part of the pelvis, through the ſacro-ſciatic notch, and takes its courſe down the back of the thigh into the ham. In this courſe it ſupplies the muſcles lying on the back of the thigh, but its chief deſtination is to the leg and foot.

OF THE CUTANEOUS NERVES OF THE THIGH.

It will be found conſiderably to take from the intricacy of the minute anatomy of the nerves of the lower extremity, to diſpoſe firſt of theſe nerves which lie under the integuments of the thigh.

Theſe cutaneous nerves of the thigh come from the lumbar nerves, or more immediately from the anterior crural nerve. They pierce the tendon of the oblique muſcle of the abdomen, or paſs under Poupart's ligament, and are diſtributed to the groin, ſcrotum, and betwixt the faſcia and integuments of the fore-part of the thigh. There may be deſcribed five cutaneous nerves on the fore-part of the thigh, *viz.* the *external cutaneous*, the *middle cutaneous*, the *anterior cutaneous*, the *internal cutaneous*, and thoſe of the groin and ſcrotum.

The EXTERNAL CUTANEOUS NERVE is that which comes out from the belly near the ſuperior ſpinous proceſs of the ilium. It divides almoſt immediately into two great branches, and in the front view of the thigh the anterior branch alone is to be ſeen. It takes a courſe above the faſcia in the direction of the line which divides the

the vaſtus externus from the rectus femoris, and terminates near the knee, while the poſterior branch paſſes over the tenſor vaginæ femoris, and down upon the outſide and back of the thigh. It is derived from the third lumbar nerve.

The MIDDLE CUTANEOUS NERVE is ſeen amongſt the integuments of the groin, and emerges from under the faſcia near the upper edge of the Sartorius muſcle. It paſſes down upon the rectus muſcle, and is diſtributed to the integuments in three or four diviſions.

The ANTERIOR CUTANEOUS NERVE comes out to the integuments very high up, in the middle of the groin betwixt the pubes and ſpine of the os ilii. It paſſes down the thigh along the ſurfaces of the Sartorius and vaſtus internus muſcles. This, like all the other cutaneous nerves, runs above the faſcia, and immediately under the ſkin.

The INTERNAL CUTANEOUS NERVE is the leaſt regular. It does not pierce the faſcia in one trunk, but ſends three, four, or five branches through the faſcia, which are diſtributed to the integuments on the inſide of the thigh. Some of theſe, after running a conſiderable way under the faſcia, emerge and encircle the inſide of the knee.

Beſides theſe more remarkable cutaneous nerves, there come down ſmall nerves to the groin and ſcrotum. The firſt lumbar nerve ſends down the external ſpermatic nerve. This joining the ſpermatic plexus, helps to ſupply the cord and teſticle; and in women the ſame nerve goes to the womb within the pelvis, and following the round ligament, terminates on the fat of the pubes and groin. A branch from the ſecond lumbar nerve paſſes alſo to the glands and fat of the groin, the pubes, and cremaſter muſcle. This branch is remarkable for the circuitous courſe it takes round the ilium and inſide of the ligament of the thigh.

ANTERIOR

ANTERIOR CRURAL NERVE *.

THIS nerve arifes from the union of the fecond, third, and fourth of the lumbar nerves, or the fecond and third lumbar nerves uniting into one trunk, are afterwards joined by a divifion of the fourth †, or the anterior crural, is formed by the anterior branch of the third and the firft branch of the fecond lumbar nerve ‡, or by the four firft lumbar nerves; and the firft facral nerve. At its origin, it lies under the pfoas magnus, and, as it defcends, it holds its courfe between the pfoas magnus and iliacus internus. It then defcends towards the thigh, and paffes out under Poupart's ligament; and in its courfe along the brim of the pelvis, it is for fome way covered by the external iliac artery. Here, while within the pelvis, it gives off feveral fmall nerves, which pafs into the iliacus internus, and under the pfoas magnus mufcles. Thefe form a kind of fmall plexus.

As the anterior crural nerve paffes under Poupart's ligament, it fplits into its numerous branches which fupply the mufcles and integuments on the fore-part of the thigh. From the fore-part of the nerve there is fent out a mufculo-cutaneous branch, which, while it defcends and fupplies feveral of the mufcles of the thigh, gives out the middle cutaneous nerve. The anterior cutaneous nerve is fent off lower down. But almoft immediately after it has paffed under Poupart's ligament, the internal cutaneous nerve is fent off from fome of thofe branches which run under the internal articular artery.

The laft of the cutaneous branches of the anterior crural nerve, and the moft important, is the NERVUS SAPHENUS, OR CUTANEUS LONGUS. This is the chief cutaneous nerve of the leg; but it is to be diftinguifhed as a particular nerve, fo high as under the external arti-

* *Crural nerve, truncus lumborum, femoralis magnus.*

† Fifcher—Walter. ‡ Sabatier and Haller.

cular

cular or circumflex artery, being a diviſion of what is called the NERVUS LONGUS. This nerve is ſometimes joined by a branch of the obturator nerve; and the muſcular branches which it gives off, paſs into the vaſtus internus.

When we are diſſecting in the courſe of the femoral artery, we have to obſerve two nerves running parallel to, and connected with the ſheath of the artery. That which is on the inſide is the largeſt, the courſe of which we ſhall proſecute. It follows the artery through the tendon of the triceps muſcle, but it does not deſcend into the ham with the popliteal artery. It comes out again through the tendon with the perforating branches of the popliteal artery, or with the upper and internal articular artery. It then becomes a ſuperficial nerve, and deſcends upon the inſide of the leg with the ſaphena vein, to the inner ancle and foot.

Thoſe two nerves, which are ſo cloſely connected with the femoral artery in the middle of the thigh, are very often taken up with the extremity of the artery in amputation. This occaſions twitching in the ſtump and a fetid diſcharge.

Where the continued nerve deſcends upon the inſide of the leg, it ſends out many twigs to the integuments, and is entangled with the ſaphena vein. Here it has been pricked in bleeding in the ancle.—Sabbatier gives us an inſtance of this. The patient had been previouſly ſubject to nervous affections. She felt in the inſtant of the operation an acute pain, which was ſucceeded by convulſive motions, firſt of the limb and then of the whole body. Theſe attacks returned from time to time, ſhe loſt her health, and for many years was ſtill in ſuffering almoſt continual. He relates to us another inſtance of the injury of this nerve accompanying the ſaphena vein, in the caſe of a young man who received a wound with the ſmall ſword in the inſide of the knee. There came on much fever and ſwelling of the part, with great pain of the limb. This ſubſiding, there followed ſlight trembling of the limb, which gradually increaſed

to

to an extreme degree. The cauſtic was propoſed, but the patient had not reſolution to let it be applied. After long ſuffering with exhauſted ſtrength, he was at laſt relieved by nature, and his health gradually returned.

Theſe branches we have mentioned are only the cutaneous or ſuperficial branches of the anterior crural. The larger and more numerous ſet of branches are thoſe to the muſcles lying on the fore-part of the thigh. Theſe diverge ſuddenly into innumerable twigs, and are entangled with the branches of the arteries, and follow them in their diſtribution. There can be no excuſe for beſtowing particular names on theſe branches;—to ſay that one is the branch to the pectinalis, another the branch to the Sartorius, another to the rectus, &c. is ſufficient.

OBTURATOR NERVE.

THIS nerve ariſes by faſciculi from the ſecond and third lumbar nerves, and ſometimes by a ſmall twig from the fourth. It is formed, however, chiefly by the third lumbar nerve. It then lies under the internal border of the pſoas magnus. It deſcends into the pelvis, and goes obliquely downwards to paſs through the ligamentous membrane which fills up the thyroid hole. The obturator nerve, before it eſcapes from the pelvis, ſends off a branch which, accompanying the parent nerve, is given to the external obturator muſcle. When it has eſcaped from the pelvis, this nerve lies before the heads of the triceps, and behind the pectinalis muſcle; and it here divides into two branches in the very middle and internal fleſh of the thigh. The anterior of theſe branches paſſes down betwixt the adductor muſcles, or heads of the triceps, ſupplies thoſe muſcles and the gracilis, and ſends a branch of communication with the ſaphenus nerve. The poſterior diviſion goes down betwixt the adductor magnus and brevis, ſends branches to the obturator externus and adductor brevis, and continues its courſe downward before the great fleſhy partition

tion of the adductor muſcles, and parallel with the crural veſſels, to the fat above the inner condyle of the femur.

THE ORIGIN OF THE ISCHIATIC NERVE.

THE iſchiatic nerves is formed by the two laſt nerves of the loins, and the three firſt of the ſacrum: or we may deſcribe its origin more particularly thus; the anterior branch of the fourth lumbar nerve and the trunk of the fifth uniting, form a ſtrong cord of about two inches in length; this root is joined to another nearly as large, formed by the firſt and ſecond ſacral nerves; and again, a third diviſion joins it from the inferior branch of the ſecond ſacral nerve and from the third *. The iſchiatic nerve is thus formed of three great roots matted together into a kind of plexus, and then paſſes betwixt the pyriformis muſcle and the gemini, and thus eſcapes from the back part of the pelvis by the great iſchiatic notch.

But before following this great nerve into the thigh, we muſt take notice of many leſſer nerves ſent out from the ſacral nerves, and from the trunk of the iſchiatic nerve. These nerves paſs to the muſcles and integuments of the nates and back of the thigh to the perineum and private parts.

OF THE LESSER NERVES WHICH GO OUT FROM THE BACK PART OF THE PELVIS.

1ſt. THERE paſs off branches from the ſecond and third lumbar nerves, which form a muſcular nerve of conſiderable ſize. This muſcular nerve paſſes down upon the inſide of the pelvis, eſcapes from the back part of the pelvis, and is diſtributed to the gluteus

* This third and loweſt origin, before uniting with the others to form the iſchiatic nerve, gives out many ſmall branches to the hypogaſtric plexus and viſcera of the pelvis, to the perineum and private parts.

medius,

medius, the gluteus minimus, and the tenſor vaginæ femoris.

2. There paſs off one or two very ſmall nerves from the body of the iſchiatic nerve, while yet within the pelvis, or from the middle diviſions of its origins, which go to the pyriformis and gluteus medius muſcles.

3. Juſt where the great nerve paſſes over the poſterior ligaments of the pelvis, there goes off a twig to the obturator externus, gemini, and quadratus femoris. While theſe nerves are ſent off upon the anterior face of the nerve, there goes backward a large faſciculus of nerves to the glutei muſcles, and to the integuments of the nates *.

There proceeds a nerve ſomewhat more important than theſe from the third ſacral nerve, viz. the NERVUS PUDENDUS. This nerve paſſes out above the ſhort ſacro-iſchiatic ligament, and re-enters under the long ſacro-iſchiatic ligament. It then runs by the ſide of the ramus iſchii, and aſcends in the perineum and branches to the erector penis, accelerator urinæ, and tranſverſalis perinei, and paſſes on to the integuments and external parts of generation.

OF THE CUTANEOUS NERVES OF THE BACK OF THE THIGH.

WHEN the integuments are diſſected off from the nates and back of the thigh, we ſee two ſources of the cutaneous nerves; firſt from the lumbar nerves, which give out many ſmall nerves which paſs over the ſpine of the os ilii, and the branches of the anterior and outer cutaneous nerve; and ſecondly, from under the lower margin of the great gluteus muſcle, there come many extenſive cutaneous nerves. Theſe are derived from the

* Branches of that root of the iſchiatic nerve which is derived from the third ſacral nerve, go alſo out to the buttock; and ſome deſcribe a ſuperior, middle, and inferior cutaneous nerve of the nates.

nervus cutaneus poſterior et ſuperior, and branches of the iſchiatic nerve, in this manner;

Juſt as the great iſchiatic nerve has eſcaped from the pelvis, it is joined by the SUPERIOR and POSTERIOR CUTANEOUS NERVE; or, rather, a ſmall twig is ſent off from the great nerve to join this cutaneous nerve * on its emerging from the pelvis. It divides into ſeveral branches, and it is one of theſe which may be ſeen ſuperficial and above the delicate faſcia, running down upon the outer ham-ſtring muſcles, to the back of the knee-joint. Another branch piercing the faſcia ſeparately, comes down upon the integuments covering the outer and back part of the thigh, and terminates on the outſide of the knee. A little further down, the iſchiatic nerve gives off ſmall nerves to the muſcles ſurrounding the hip joint; and, whilſt the ſciatic nerve is paſſing over the quadratus femoris, the INFERIOR and INTERNAL CUTANEOUS NERVE is given off. This nerve runs down even to the inſide of the calf of the leg.—The EXTERNAL and POSTERIOR CUTANEOUS NERVE is a branch ſent off from the iſchiatic nerve, after it has deſcended from under the gluteus maximus, and juſt before its diviſion into two faſciculi, viz. the tibial and peroneal nerves. This external and poſterior cutaneous nerve paſſes down upon the integuments of the back part and outſide of the leg.

OF THE TRUNK OF THE ISCHIATIC NERVE IN THE THIGH.

BUT we muſt not allow theſe leſſer branches to diſtract our attention from the general courſe of the great nerve, which paſſes over the gemini muſcles, betwixt the tuberoſity of the iſchium and the trochanter major, then runs deep under the bellies of the hamſtring muſ-

* The poſterior cutaneous nerve riſes in general from the trunk of the iſchiatic nerve, within the pelvis, and is joined by a branch from the third ſacral nerve.—Ioerd. Haaſe.

cles,

cles, and is lodged immediately in the great cavity behind the knee-joint, in company with the popliteal artery and vein. In this courſe the ſacro-ſciatic gives off branches to the quadratus femoris, the biceps cruris, ſemitendinoſus and ſemimembranoſus and triceps.

A little below the middle of the thigh, the great iſchiatic nerve divides into the internal and greater, and the leſſer and external popliteal nerves. But as this is really the diviſion into the two great nerves of the leg, we take the more determinate names of tibial and fibular nerves.

TIBIAL NERVE.

THE greater and more internal of theſe diviſions of the popliteal nerve, is the tibial nerve. Whilſt it is yet in the hollow behind the joint formed by the hamſtring tendons, it gives off a nerve which comes out from the ham, and deſcends ſuperficially on the back of the leg. This has been called RAMUS COMMUNICANS TIBIALIS. When this nerve has arrived oppoſite to the beginning of the tendon Achillis, it turns a little to the outer ſide, paſſing upon the outer margin of the Achillis tendon, over the outer ſide of the heel-bone, and is finally diſtributed on the outſide and fore-part of the foot. Upon the back of the leg, this nerve unites with a branch deſcending from the fibular nerve, nearly in the ſame courſe, and with the ſame deſtination.

After giving off this ſuperficial branch, the tibial nerve ſends branches to the back of the knee-joint and popliteus muſcle, to the plantaris muſcle, and to both heads of the gaſtrocnemius. It then deſcends behind the articulation, and behind the head of the tibia. It then paſſes under the origins of the ſoleus, and betwixt the ſoleus and flexor longus digitorum pedis, and tibialis poſticus, and deſcends to the inner ancle. In this courſe it furniſhes many branches to the lower part of the popliteal muſcle, to the tibialis poſticus, to the flexor communis digitorum, and to the flexor pollicis longus, and many of theſe branches, end in cutaneous twigs. We

have alſo to obſerve a particular branch which the tibial nerve detaches, which paſſes betwixt the heads of the tibia and fibula, and goes to ſupply the muſcles ariſing from the fore-part of the interoſſeous ligament. Further down, two or more ſmall branches of the nerve alſo perforate the interoſſeous ligament, to ſupply the muſcles lying on the outſide of the tibia. The tibial nerve, in its courſe amongſt thoſe poſterior muſcles, accompanies the poſterior tibial artery. When it has arrived behind the inner ancle, it ſends off a branch to the integuments of the inſide of the foot, and to the abductor muſcle of the great toe. Continuing its courſe by the ſide of the heel-bone and under the ligament, it begins to ſplit into thoſe branches which are naturally called the plantar nerves, becauſe of their lying in the ſole of the foot.

THE PLANTAR NERVES.

THE internal plantar nerve paſſes over the abductor muſcle of the great toe, and by the inſide of the ſhort flexor to the firſt metacarpal bone; and in this courſe it gives out ſeveral twigs to the muſcles of the ſole of the foot. It now divides into three branches. Theſe are diſtributed to the great toe, to the ſecond, the third, and one ſide of the fourth toes; and theſe nerves in their courſe give branches to the lumbricales and interoſſii muſcles.

The external plantar nerve is the leſſer of the two. It gives branches to the ſhort flexor and adductor of the little toe, and to the maſſa carnea Jacobi Silvii. It gives alſo a deep branch to the third and fourth interoſſeous muſcle and adductor muſcle of the great toe. Another of its branches makes the arch with the internal plantar nerve, while its extreme diſtribution is to the little toe, and to one ſide of the fourth toe. Theſe nerves of the ſole of the foot are connected with the internal and external plantar arteries, and are protected like them by the plantar aponeuroſis.

THE FIBULAR NERVE.

The fibular nerve is the more external divifion of the popliteal nerve. It feparates from the tibial branch about four inches above the knee-joint; it does not pafs down under the gaftrocnemius, like the tibial nerve, but turns towards the outfide of the joint, and paffes round the head of the fibula, and under the origin of the peroneus longus.—Before the fibular nerve paffes from behind the joint, it gives off feveral branches. There are fent down two branches to the integuments. One of thefe branches unites with the communicans tibialis, and defcends with it to the outer ancle. Sometimes this anaftamofis is formed high in the leg upon the heads of the gaftrocnemius. More generally there is a double communication formed by thefe nerves about the termination of the belly of the gaftrocnemius mufcle in the Achilles tendon. This prolonged branch of the fibular nerve terminates upon the fide and upper part of the foot, and upon the little toe. There are alfo fome nerves fent off from the fibular, which are diftributed about the back and fides of the knee-joint.

When the fibular nerve has turned over the head of the fibula, it divides into two great branches. The DEEPER SEATED OF THESE BRANCHES, though it is not the largeft of them, may be confidered as the continued trunk. It paffes deep amongft the mufcles, lying betwixt the tibia and fibula, and fupplies the tibialis anticus, the extenfor communis digitorum, extenfor longus pollicis, and the peroneus brevis. Thus the deeper divifion of the fibular nerve, taking its courfe between the tibialis anticus, and the peroneus longus mufcles, and lower down betwixt the tibia and extenfor pollicis longus, continues giving off branches in rapid fucceffion, and when it arrives at the anular ligament, it is much diminifhed. Here it divides into the *ramus dorfalis pedis profundus*, and *fuperficialis*.—This divifion is made

made after the nerve has croffed under the tendon of the tibialis anticus mufcle, and, while it lies betwixt the lower heads of the tibia and fibula.—Although they are diftinguifhed by the name of deep and fuperficial branches, they are both deep compared with the extremities of the great and outer divifion of the peroneal nerve. The branch which lies moft towards the outfide of the foot, paffes under the extenfor digitorum brevis mufcle, and on the outfide of the tarfus. It diftributes its branches to the extenfor digitorum brevis, and interoffii mufcles. That branch which is more towards the infide of the foot, although diftinguifhed by the term fuperficialis, goes forward not only under the fafcia which covers the foot, but alfo under the tendons; and after dividing and again uniting, and after fending off fome fmall branches, it comes out betwixt the great toe and the fecond toe, and fends numerous branches to their contiguous furfaces.

The GREAT SUPERFICIAL DIVISION of the FIBULAR NERVE is fometimes double, or immediately fplits into two. Its firft branches are to the peroneus tertius, extenfor longus digitorum, and to the peroneus brevis and fecundus. The trunk or principal divifion runs down under the head of the peroneus longus, and then coming out from under it, continues its courfe beneath the ftrong aponeurofis, which covers the mufcles on the fore-part of the leg. It then pierces the aponeurofis and becomes cutaneous, and runs obliquely down to the convexity of the foot, giving off in its courfe a nerve which paffes over the outer ancle.

THE METATARSAL NERVES.

WHEN the fuperficial branch of the peroneal nerve defcends before the ancle-joint, it divides into the metatarfal nerves, or the rami dorfales pedis. The EXTERNAL of thofe branches paffes above the tendons, and above the tendinous expanfion on the dorfum pedis; is united to the extreme branches of the ramus com-

municans tibiæ, and is finally diſtributed to the outſide of the third toe, to the fourth, and to the inſide of the little toe.—The INTERNAL branch is again ſubdivided; one branch extends over the middle of the foot to the ſecond and third toes, while the other paſſes ſtraight along the metatarſal bone of the great toe (above the tendons); ſends many branches over the inſide of the foot, and terminates on the inſide and dorſum of the great toe.

[illegible] OF THE SECOND VOLUME.

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